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Some Seasonal Reflections

THE French have a pleasing habit, seeing the stranger sitting down to one of their sumptuous meals, of wishing him *bon appétit*; and in wishing to all our readers a very happy Christmas we venture to echo this courtesy. For who has a better right to enjoy his Christmas dinner than the veterinary surgeon, whose care and skill have done so much to help provide it? And then, not only is there the the food; there is also the drink. Jewel of jeopardy! And since an editor is (or likes to think he is) a kind of father to his readers, let us sound a warning note drawn from no less an authority than the noted Victorian advocate of total abstinence, Dr. Talmage.

"The intoxicants of olden time" (wrote this gentleman) "were an innocent beverage, a harmless orangeade, a quiet syrup compared with the liquids of to-day, into which a madness and a fury and a gloom and a fire and a suicide and a retribution have mixed and mingled. The arch-fiend . . . poured into a cauldron capsicum and copperas and logwood and deadly nightshade and assault and battery and vitriol and opium and rum and sulphuric acid and cochineal and red carrots and hops. Then . . . he put a shovel into that great cauldron, and it began to heave and rock and boil and splutter and hiss and smoke, and the nations gathered round it with cups and tankards and demijohns and kegs."

No wonder.

Looking through the year's issues of THE VETERINARY RECORD with as much complacency as seemed to be justified by the subject, we were struck by the singular aptness of some of the phrases in the correspondence on The Behaviour of Cattle in Crushes to the unwritten rules which authors must surely keep by them for the management of editors. (In this context what Dr. E. L. Taylor referred to as *Bos taurus* and *Homo sapiens* may be taken as synonymous). At Christmas time we may well put on a seemly humility; and in any case knocking the breast is not only salutary but is said to be an effective therapy in seasonal attacks of dyspepsia. Authors, both mature and debutant, may wish to keep these quotations from the correspondence by them.

"These animals" (wrote Mr. J. B. White) "strongly resent restraint in any way . . . they can, if they lose their tempers, become a real handful." His view was supported by another clinician of ripe experience. "Of course" (observed Mr. Wilkinson) "a young, vigorous beast which . . . suddenly finds itself confronted by fences . . . is apt to get het up."

Then how to manage the creature?

Mr. Wilkinson, continuing, says with his usual combination of humanity and good sense, "holding . . . by its nostrils is unwise; 'nursing' the head in the arms is far preferable."

Decidedly so!

Mr. E. G. Morris is even more forthright, though his recommended method of restraining the animal would make the average editor blench. "Grabbing . . . by its nostrils, particularly when the hand is horny, strong and armed with protruding nails may cause . . . increased resistance next time." We should think so! "The use of a light but rigid metal ring . . . which fits comfortably over the whole nose avoids much of this trouble." Intending authors should get their wives to buy them one for Christmas.

Mr. J. A. Lawrence, who clearly comprehends the essential timidity of editors, observes that "caught in the bail (they) often assume a kneeling posture." So they do. But his compassion is no sooner excited than it evaporates, and he suggests that a method for overcoming semi-recumbency is "to bite the tail."

It was left for a lady, Miss Littlejohn, to illustrate, as was but fitting, the gentle virtues of her sex. "Mere figures," she said, "can give no hint of the obvious relish with which many . . . participated . . . one . . . after another trotting along like a skittish pony. . . . It is perhaps unnecessary to add that these animals *were handled gently*."

Is it any wonder that Miss Littlejohn's too infrequent contributions to our pages are invariably accepted for publication?

But, as Dancing Dan said to Damon Runyon's other gangster before they dropped in on the jeweller, "it is coming on Christmas"; and the finer feelings of editors, if they have any, must be put on the shelf while Christmas good wishes are voiced. We extend them most heartily to all our readers. May clinicians not be sent for on Christmas Day; may research workers' experiments all turn out right; may every School have a double apportionment from the University Grants Committee; may students conduct themselves with decorum; may Austin have his swink to him reserved, and every Jack get his Jill. In fact—a very happy Christmas to everyone.

Symposium on Some Modern Feeding Methods

1.—The Early Weaning of Lambs

BY

C. R. W. SPEDDING, R. V. LARGE and T. H. BROWN

The Grassland Research Institute, Hurley, Nr. Maidenhead, Berks.

THE separation of ewes from their lambs is normally carried out before weaning would be completed naturally, primarily because the requirements of the ewes and the lambs are no longer similar. It may be desirable, for example, to restrict the intake of the ewes while allowing maximum intake by the lambs. Creep-grazing is a method of exerting differential control without weaning and its use reflects the fact that the requirements of the ewe and the lamb may differ quite soon after lambing. These differences may be increased with intensity of sheep husbandry: a situation may be visualised that involves a level of prolificacy at which the ewe provides insufficient milk for all her progeny. The early weaning of some lambs would then be essential and, if more frequent breeding were also required, the removal of all lambs might be necessary. This point would obviously depend on the milk yield of the ewe, taking into account the whole environment (including stocking rate, management and feed supply) as well as the animal's genetic potential.

Before discussing the agricultural objects and veterinary implications of early weaning, we must consider how early a lamb can be weaned and what are the factors governing this. Strictly speaking, weaning is a process during which the young animal learns to take food other than its natural milk supply. For the purpose of this discussion, however, early weaning is defined as the cessation of liquid feeding at an age when milk is normally a major constituent of the diet. It may, therefore, be applied both to the naturally suckled and to the artificially reared lamb; the former will be considered first.

The Naturally Suckled Lamb

It is well known that lambs consume large quantities of grass or other solid food long before the normal weaning age (3 to 5 months) and that, in many circumstances, weaning at 2 to 3 months results in performance differing little from that of unweaned lambs (Barnicoat, Murray, Roberts & Wilson, 1956; Bonsma & Engela, 1941; Bosman & Bonsma, 1944; Clark, 1954; Wardrop, Tribe & Coombe, 1960). Clearly, there comes a time when a lamb can, or will, consume enough of the non-milk diet to replace the nutrients supplied by milk. If it is able to utilise the new diet efficiently its growth should remain satisfactory. The necessary intake or efficiency of utilisation, however, may depend upon the development of the animal as well as on its age. Thus, the result of weaning may be affected by the age and health of the lamb and by the diet before and after weaning. In addition to the effect on the lamb, the effect on the ewe of the removal of one or all of its lambs must be considered.

Several experiments have been carried out at Hurley in which one lamb from a pair of Suffolk × Halfbred twins has been weaned at 2, 3 or 4 weeks, by abrupt removal of the lamb from the ewe (Spedding, Brown & Large, 1960; Spedding & Brown, 1961).

The number of lambs so treated has been small but no losses have so far been recorded. In general, such lambs suffer a check in growth rate immediately after weaning varying in duration from 1 to 4 weeks; as might be expected, there is a tendency for the size of the lamb to influence the magnitude of this check. The weight and vitality of the lamb may be of greater importance in this respect than age. Lambs weaned on to grass alone at 15 to 21 days have been sent off fat at ages ranging from 169 to 228 days (Table I a and b). Lambs weaned at 2 or 4 weeks have been fattened indoors on concentrates and hay in much shorter periods (Table I c and d). The evidence indicates that, while lambs can live on grass from 15 days of age, grass alone (or, more strictly, the grass so far used for this work) does not result in normal growth rates until the lambs are about 6 weeks old. At present, growth rates comparable to those of normally suckled lambs can be achieved only by some degree of supplementary feeding during the second month. The biological and economic optima in quantity, quality and timing of this feeding remain to be determined. The subsequent growth rate of early weaned lambs on grass may be much influenced by infestation with stomach and intestinal worms.

At Hurley, the growth of the twin lamb left on the ewe has been significantly better than that of normal twins under comparable conditions. Although, theoretically, the milk available to such a lamb should be greater than that available to a normal single, owing to the stimulus of initial suckling by 2 lambs (Barnicoat, Logan & Grant, 1949; Alexander & Davies, 1959) the animal's overall performance rarely differs significantly from that of a single lamb because it has been suckled as a twin for some weeks. The results with Suffolk × Halfbred lambs suggest that the optimum time to wean, from this point of view, is between 2 and 3 weeks. This, however, might be greatly influenced by breed differences. Where weaning occurred later, some of the lambs

* Papers presented to the Annual Congress of the British Veterinary Association in Oxford on Friday, September 8th, 1961.

TABLE I
GROWTH OF EARLY-WEANED LAMBS
(SUFFOLK × HALFBRED TWINS)

Year	Feeding régime		Age at weaning (weeks)	Number of lambs	Number of days from birth to slaughter (Range)	Mean L/Wt. Gain per head per day			
	Before weaning	After weaning				Birth to weaning	S.E. of the mean	Weaning to slaughter	S.E. of the mean
(a) 1959	Suckled on the ewe	Grass only	2—3	6	203—228	0·76	±0·0456	0·25	±0·0075
(b) 1960	,,	,,	3	12	169—196	0·72	±0·0338	0·35	±0·0097
(c) 1960	,,	Indoors on hay and concentrates	4	6	112—188	0·67	±0·0733	0·50	±0·0476
(d) 1960	,,	,,	2	6	111—157	0·81	±0·0673	0·48	±0·0215
(e) 1960	Milk substitute and concentrates	,,	2	9	134—190	0·55	±0·0531	0·46	±0·0184

remaining with their ewes failed to suck both sides of the udder. These lambs did not necessarily grow less well than those sucking both quarters, however, and in none of the ewes was any udder trouble recorded. Behaviour of the ewes was little affected by weaning one lamb from a pair, and the effect on the behaviour of the weaned lambs was short-lived (about 24 hours) and lessened where larger numbers were involved.

The Artificially Reared Lamb

Where artificial rearing is employed, weaning and removal from the ewe may be considered separately. Removal may take place before a lamb can be weaned, *e.g.* within the first 2 weeks. The effect on the ewe must be related to whether it is left with a milk output greater than the remaining lamb(s) can take. This is unavoidable when all lambs are removed. This has been done at Hurley on several occasions, either at birth or when the lambs were a few days old.

When all the lambs have been removed at birth from Dorset Horn ewes, colostrum has been withdrawn during the first 24 hours and the ewes have been confined indoors and milked out when necessary. There have been few problems associated with this but it may be unnecessarily laborious. In March, 1960, all lambs were removed between 1 and 5 days old from 36 Halfbred ewes (aged from 2 to 6 years). Each ewe was confined indoors, without milking, and fed only dry hay. No water was supplied. Sixteen ewes were given intramammary injections of penicillin*; 20 were left untreated. The udders were regularly inspected and no differences were observed between those treated and untreated. One ewe in each group developed a hardness in one quarter; no mastitis was recorded. Each ewe was turned out on to bare pasture when its udder condition appeared satisfactory (declining in size); this took from 7 to 10 days. A similar procedure was carried out in February, 1961, with 35 Dorset Horn ewes, the lambs being removed at birth but colostrum withdrawn during the first 24 hours. Penicillin was injected in all cases but, in spite of this, 7 ewes developed mastitis, 2 of them seriously (one resulting in death). The ages of the ewes at lambing ranged from 1 to 8 years and the incidence of mastitis was highest in the older animals.

Restriction of water intake is a simple method of drying off ewes whose lambs have all been removed within a few days of birth. Although this procedure has resulted in no adverse consequences with some sheep, it has not always proved satisfactory. The extent to which it is applicable must await further investigation, particularly in relation to ewes at their peak of lactation.

In general, where lambs are to be reared artificially, it is best to remove them from the ewe at about 2 days to ensure a plentiful supply of natural colostrum: if lambs are weak this is better done by removing them at birth and feeding colostrum from a bottle.

Lambs may be artificially reared on a variety of liquid and solid foods, from a number of different feeding devices for various periods of time (Large, 1960, 1961). The concentration of the liquid feed and the frequency with which it is fed, the physical nature and chemical composition of the solid food, all these and many other factors may affect the progress of the artificially reared lamb and it is not possible to isolate completely the particular problems of weaning.

It has been found possible to obtain growth rates for some artificially reared lambs comparable to those of lambs reared on the ewe but the cost may be prohibitive. There is at present no evidence as to the best milk substitute to feed: these high growth rates were in fact obtained by feeding full-cream, dried milk mixed with water at the rate of 1½ lb. per gallon. This results in a liquid of the following approximate composition: 5.7 per cent. fat, 5.4 per cent. protein, 7.2 per cent. lactose. This was fed to appetite 4 times a day; the intake by the lambs is shown in Table II. This level of feeding is expensive and may be uneconomic when the lamb becomes capable of satisfactory performance on cheaper feeds.

Similar considerations apply to the weaning of

* 25,000 I.U. "Burcillin" to each teat.

TABLE II
INTAKE OF MILK SUBSTITUTE BY LAMBS
(FED TO APPETITE FOUR TIMES A DAY)

Breed	Mean number of pints per head per day during week				
	1	2	3	4	5
Dorset Horn	2·8	4·5	5·5	6·3	6·8
Welsh Mountain	2·4	2·3	2·3	2·6	3·3

artificially reared lambs and those reared naturally, but there are some differences.

The nutrition and environment of artificially reared lambs can be more strictly controlled. If they are not more subject to disease this may result in more uniform growth rates and, where this is so, artificially reared lambs can be of great experimental value. Perhaps the most important difference, however, is that early weaning can be gradual for the artificially reared lamb but is almost bound to be abrupt for the lamb reared naturally. The difference between the effect of abrupt and gradual weaning depends on the age of the lamb and also on the level of liquid feeding. An experiment with Dorset Horns showed that, when concentrates were offered *ad lib.*, feeding 14.2 lb. air-dry milk per head over a 6-week period gave no better growth than feeding 7.9 lb. over a 16-day period. Since the latter is cheaper and less laborious it has been adopted at Hurley as a standard technique. As it involves feeding at a high level for a short period, gradual weaning seems appropriate. The method used at present is as follows. Lambs are fed the milk substitute (with added vitamins at the rates of 30 I.U. of vitamin D_2 and 120 I.U. of vitamin A per lamb per day) to appetite 4 times a day for 7 days. Three feeds are given on days 7 to 9, two on days 10 to 12 and only one on days 13 to 16. The lambs are thus progressively weaned, a process which is complete on the 17th day. Concentrate pellets, hay and water are available at all times. It is difficult to give a fair picture of the performance of such lambs, derived as it is from many small-scale experiments involving different breeds, feeds and feeding methods. Table III attempts to present such a picture.

Successful early weaning of the artificially reared lamb appears to be possible at about the same time as with the naturally reared lamb. All the experiments with the former, however, have involved weaning on to concentrates and grass or hay, not on to grass alone. In one experiment, in 1960, the same post-weaning treatment was given to both kinds of lamb. Six Suffolk × Halfbred twin lambs were weaned abruptly from their ewes at 2 weeks of age, and fed hay and concentrates indoors. Nine artificially reared twin lambs of the same cross were also weaned abruptly at 2 weeks of age and fed similarly in the same building. The lambs reared naturally grew considerably better before, and slightly better after, weaning (Table I d and e). The results of this limited comparison cannot be taken to indicate the potential of either rearing method but they do suggest that there is no need to rear artificially any lamb that can be adequately fed by its ewe for the first 2 weeks. There may, however, be reasons unrelated to milking ability why the ewe should not suckle the lamb.

In summary, then: lambs, at least of the breeds studied, can be weaned from 2 weeks of age; it does not seem very likely, at present, that earlier weaning would prove satisfactory, though this is not impossible. Unless there are reasons why a lamb cannot be suckled by the ewe for a fortnight, it is better to wean it directly from the ewe than to rear it artificially.

Problems Associated with Early Weaning

In the ewe, the main problems are likely to arise when all the lambs are removed at the peak of lactation. Mastitis may occur and the udder may be permanently damaged.

Neither the early weaned lambs nor the lambs left with the ewe have exhibited problems which are directly attributable to the weaning procedure. The early weaned lambs are, however, rather more liable to some diseases and disorders, particularly those associated with the intake of grass. Worm-infestation can have a marked effect on the growth of early weaned lambs that depend entirely upon grazing. This can be completely avoided on clean pasture or by rearing indoors. The most serious problems are associated with artificial rearing. Table IV shows the incidence of disease during artificial rearing at Hurley. The data are summarised for convenience under breed headings and are derived from a variety of feeding regimes, both indoor and outdoor.

In addition to specific diseases and disorders, there are problems of management, involving labour and cost as well as health. Although early weaning itself is simple and relatively free from difficulties, the associated procedures may not be. Artificial rearing is at present rather laborious, though it need no longer be particularly costly. It is worth noting that the cost of rearing a lamb artificially always appears high compared with the largely uncosted natural process. There is little doubt that it could

TABLE III
PERFORMANCE OF ARTIFICIALLY REARED LAMBS (WEANED BY 17 DAYS OF AGE)

Breed	Rearing	No. of lambs	Mean Live-weight Gain (lb.)			
			0—5 weeks	S.E. of mean	5—10 weeks	S.E. of mean
Dorset Horn	Indoors (1960)	18	14·3	±0·693	13·3	±0·567
Dorset Horn	Indoors (1961)	40	10·4	±0·379		
Welsh Mountain	At pasture	12	7·9	±0·419	14·7	±0·733

TABLE IV
INCIDENCE OF DISEASE DURING ARTIFICIAL REARING

Breed	Number of lambs*	Scouring		Abomasal bloat		Deaths due to other causes
		Number affected	Number died	Number affected	Number died	
Dorset Horn	152	76	6	8	5	1 (brain infection)
Suffolk × Halfbred	169	130	3	30	15	3 (suspected listerellosis) 3 (unknown causes)
Welsh Mountain	66	44	1	1	1	17 (Dieldrin poisoning) 1 (Pulpy kidney) 1 (Infected navel) 3 (Digestive upsets) 2 (Contagious pustular dermatitis)

*All lambs were from ewes which received injections for both pulpy kidney and lamb dysentery, except for the Welsh Mountain lambs which were injected on arrival.

be made less laborious by some degree of mechanisation of the milk feeding process.

Agricultural and Veterinary Implications

Quite apart from the aspects already discussed, there are implications in early weaning that may be of considerable importance to sheep husbandry. The fact that a lamb can be satisfactorily reared independently of the ewe, whether from birth or from a very early age, removes one of the objections to increased litter size. It also makes it possible to visualise more frequent lambing. High productivity in a sheep enterprise tends to result from a combination of high prolificacy and high stocking rates. There are difficulties in this combination and it may be that the complete separation of ewes and their lambs could provide the basis of a solution. It is too early to assess the value of such separation but the possibilities should be recognised. One possibility is that, if ewes and lambs are separated in order to provide them with what are, in effect, two different environments, this separation might involve considerable distances. The possibility of sustaining an intensive breeding flock on the hills and rearing the progeny in the lowlands, is an example of this. Two experiments were carried out at Hurley which have a bearing on this.

In 1959, 26 Welsh Mountain lambs, born in late April on Plynlimon, were removed from their ewes within a few days of birth and transported to Hurley (mean live-weight on arrival, 6.0 lb.). They were reared on clean pasture; water, hay and concentrates were provided *ad lib.* and milk substitute (as previously described) fed to appetite 4 (or 6) times a day. Four feeds a day gave similar results to those obtained with more frequent feeding. The lambs were weaned at 6 weeks and lived on grass alone from 7 weeks. From birth to 3 months they were maintained on $\frac{1}{2}$ acre; they were then fattened on a grass/lucerne mixture at a low stocking rate (2/acre with surplus herbage conserved as silage). The mean growth rate from birth to slaughter (in the following December and January) was 0.23 lb. per head per day, and there were no losses. In 1960, 40 lambs were collected in the same way but were weaned much earlier. Losses in this year were heavy but the majority were ostensibly due to dieldrin poisoning, which resulting in the death of 17 of the lambs following dipping at 3 to 4 weeks of age. Dipping involved immersion of the body (not the head) in normal strength dip for 5 sec. Symptoms were consistent with dieldrin poisoning and no other cause of death was apparent *post mortem*. The poorer lambs were, in general, most seriously affected and it would appear that the use of a dieldrin dip for artificially reared lambs is not to be recommended at this early age.

The progress of the survivors, however, was better than in the previous year. Their mean growth rate from birth to slaughter (in October) was 0.31 lb. per head per day.

The cost of the milk substitute and concentrates was £2 per head in 1959 and 11s. 6d. per head in 1960.

Removal of lambs to a more favourable climate could have repercussions on date of lambing and thus on winter feeding, on the stocking rate that could be carried, on the wool production of the ewes and on mortality during the first few weeks of lambing. Whatever the distances involved, however, separation of ewes and lambs makes possible a degree of concentration of young animals, indoors or at pasture, much higher than is possible when they are not so separated. Stocking rates of young lambs of up to 36 to the acre have presented no problems at Hurley, in a relatively worm-free environment. It cannot be assumed that this would be the case in other circumstances.

It should be stressed finally, that there is at present little justification for the early weaning of lambs that could be fattened by the ewe within existing farming systems. Should there be a practical application for early weaning it is likely to be associated with changes in farming systems directed at increased intensity of production.

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2.—Silage Self-feeding

BY

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Development of Silage Self-feeding

SILAGE self-feeding means the practice of animals helping themselves at the silage face, as opposed to the cutting out and carting of silage and taking it to them. Vertical grazing has been a term applied to this system which is becoming quite popular. On unrestricted feeding the animals are allowed 24-hour access whereas with restricted feeding they may be allowed 8 hours or less at the silage, the remainder of the time being spent in their lying quarters probably having hay, or dairy cows can be grazing kale in the day-time and self-feeding silage at night.

Origin of Silage Self-feeding

The idea is supposed to have started in the United States of America where it is reported that silage was thrown down to racks around the base of tower silos. We follow the methods of the Americans in many things and in this country there are now some of the very latest auger feed systems from tower silos.

I am not quite sure where silage self-feeding started in the United Kingdom. Buckinghamshire vies with Northern Ireland but I am inclined to settle for the latter. Over 12 years ago a prominent farmer let his stores run loose whilst mucking them out. When the job was finished he found them grazing contentedly at the silage. They were allowed to stay there till night-time with no ill-effects, and being an opportunist, and always looking for a better method, the cows were at the silo 2 days later and there has been no cutting and carting of silage to them since.

The Class of Stock which can Self-feed

Whilst most of our attention is devoted to the dairy cow and self-feeding is gaining in popularity with dairy farmers, information is also available about self-feeding beef cattle, stores, nurse cows, beef cows with calves, and even sheep. The practice has been quite satisfactory in nearly all cases except where the total daily intake of nutrients which was inadequate due to too great a height of silage, and to serious over-consolidation, making it difficult for the stock to pull it out.

Close observation has not found any trouble with teeth in adult stock but with young cattle when the first pair of permanent incisors are replacing the milk teeth, trouble is sometimes encountered and any cattle unable to self-feed properly should be drawn out and hand-fed for a time. Restricted self-feeding is best for dairy heifers otherwise they may get too fat if the silage is of reasonable quality. Beef cows should also be restricted in their intake as they get too fat, and when freshly calved give too much milk which often causes scouring in the calves.

How to Make Good Silage

The quality of silage depends on three main factors which are inter-related:—

(i) Stage of maturity of the grass when cut.
(ii) The dry matter content of the grass.
(iii) The type of fermentation in the silo.

(i) *Maturity of the Grass*

The less mature the grass, the higher will be its protein content and digestibility. The best silage should therefore result from cutting young grass. For self-feeding dairy cows which are getting little or no concentrates, the aim should be silage having 15 per cent. crude protein in the dry matter, which would mean cutting the grass before any seed heads appear.

(ii) *Dry Matter Content*

Wilting of grass improves the quality and also enables the cow to take in more dry matter.

The higher the dry matter content the more concentrated are the nutrients in silage provided that the higher dry matter is the result of wilting rather than cutting at an advanced stage of maturity. Silage made in dry weather from freshly cut young grass will normally have a dry matter content approaching 20 per cent. Wilting the grass for 24 hours (or less in sunny weather) can raise the dry matter to 25 per cent. or more.

(iii) *Type of Fermentation*

It is believed that chopping and laceration by the use of a forage harvester aids fermentation and provides a suitable medium for formation of lactic acid. The addition of molasses also ensures better fer-

mentation by providing sugar easily converted to lactic acid. Up to 4 gallons per ton of grass may be necessary if the grass is very leafy. Temperature is more easily controlled in chopped material which should not be allowed to rise above 100° F. unless the grass is very wet. Spring silage, if the fermentation is good and the dry matter content reasonable, gives best results both for milk and beef production because of the higher sugar content of the herbage.

Other Essentials for Best Results

A suitable layout with silage on concrete which extends to form an apron to the face is essential to enable the area to be kept clean. Slurry can be a problem unless it is cleared away daily, preferably to fields. Slatted floors have been used for wintering stock in districts where bedding is scarce and the making of silage on slats is being tried and might solve the problem of daily cleaning.

A roofed shed keeps winter rain off the silage and the stock and the provision of a shelter from prevailing winds encourages them to feed as they wish if the weather is bad. The original conception of stock battling with mud at an open-air clamp did little to make self-feeding popular. A Dutch barn holding silage, with a lean-to on each side for lying in, comprises a common layout. Stock from each lying area can feed at either end. The bed and breakfast idea of allowing cows to lie on the top of the silage may reduce the cost of yarding.

Adult cattle can reach up to a height of 7 feet but if the silage is any higher it must be cut and thrown down. Yearlings can eat at a face up to 5 feet high.

Some form of barrier is needed to prevent the animals from burrowing holes unless the clamp is very tightly packed. An electrified length of piping about 2 feet 6 inches from the ground and 1 foot out from the face is sufficient. A more elaborate form where yokes are placed in front of the silage will discourage bullying.

Allowing sufficient width at the face is important but too much may encourage bullying. For unrestricted feeding a space of 6 to 9 inches per cow is required but if access to the silo is limited to two hours per day, 2 feet 6 inches per cow is needed so that each cow can feed at the same time.

An artificial light in the silo is necessary both for the benefit of animals feeding and for the stockmen to see that everything is all right.

Advantages of Self-feeding

1. *Saving of Labour*

The most obvious advantage of self-feeding is the saving of labour in cutting and carting of silage. This is hard work and unnecessary double handling. A survey of 59 farms (1953) gave the following data:—

Cutting out silage	= 17	man minutes per ton
Loading silage	= 30	" " " "
Transporting	= 16	" " " "
Feeding to stock	= 31	" " " "
Total	= 94	" " " "

With tractor charges the cost per ton of silage for this job might be from 10s. to 15s. At week-ends particularly, on the family farm any removal of drudgery is well worth while. With hired labour the hours saved through self-feeding must be profitably utilised on other work.

2. *Contentment and Condition of Cows*

The attraction of the system is the quiet contentment of the cows. When self-feeding begins for the first time cows are inclined to gorge themselves and queue up to get at the silage. In a few days they soon realise that they are not stealing and settle down to a normal pattern of feeding. The effect of being able to eat when they feel like it makes them content and their " condition " improves. This fleshing up shows clearly towards the end of the winter.

3. *Absence of Smell with Self-feeding*

The clinging smell of silage has been one of the major complaints from the domestic side of farming. With self-feeding there is no smell because only the vertical face is exposed. When silage is fed to cows tied in stalls the milk can develop a taint from uneaten silage lying in mangers, but there appears to be little danger of taint when cows are self-feeding. In one study, however, milk from individual cows which were feeding immediately before milking was found to be tainted, although there was no taint in the bulk milk (Smillie & Walker-Lowe, 1957). Shutting off the cows from the silage for an hour before milking will prevent this.

4. *Saving of Concentrated Feeding-stuffs*

There is no doubt that with unrestricted self-feeding the intake of silage results in a greater daily consumption per cow than when fed normally in mangers twice daily. Increased appetite is due to the opportunity for a number of small feeds in place of two heavy feeds. The effect of the larger intake of silage gives more nutrients and reduces the amount of the same nutrients needed in supplementary foods. This is very true with protein (the most expensive component of the ration) as 90 to 100 lb. of *good* quality silage theoretically provides sufficient for maintenance and 4 gallons of milk. The starch equivalent content of silage is lower in comparison than protein and starchy food is required after 2 gallons. The use of home-grown barley or beet pulp for the third and fourth gallons results in a cheap concentrate feed, compared with the more expensive dairy cake which is required after the fourth gallon. This substitution of home-grown starchy foods for dairy cake can amount to considerable economy in the total cost of supplementary food for a cow over the winter.

5. *Gradual Seasonal Changes Possible by Self-feeding*

The change from autumn to winter feeding and from winter to spring grazing should be done over a period with no abrupt change, as all good stockmen know. With self-feeding it is possible as winter

comes on to bring the cows in after evening milking for an hour at first, and later allow them longer at the silage over a week or more before they are kept in all night. At the end of winter the cows can go out to grass for an hour, coming back to silage, with the time at grass being extended gradually until they are out all day. This system is easily worked in practice and prevents fluctuations in milk yield and digestive and nutritional upsets which occur with abrupt changes of food.

Disadvantages of Self-feeding

(a) *Capital Required*

The main disadvantage to self-feeding silage is the capital required in providing a proper building layout. The system gives best results when combined with loose housing and parlour milking. The capital needed varies from farm to farm and depends on the use that can be made of existing buildings. Where cows are already yarded and parlour milked, and it is possible to improve an adjoining Dutch barn for silage self-feeding, no great expenditure may be necessary. On the other hand, if cows are milked in a cowshed and a parlour and silage sheds must be erected, the outlay can be considerable.

The results of a conversion of a traditional cowshed feeding and milking system on our Cheshire farm are interesting. On this farm we had 2 herds with similar cow numbers, milked and fed in cowsheds. Two years ago one shed with stalls for 72 cows was converted to loose lying, silage self-feeding, and a milking parlour installed in an adjoining building. An additional Dutch barn was added to those already situated close to the buildings with a capacity of 750 tons of silage for self-feeding. The conversion was approved for grant aid under the Farm Improvement Scheme, the *net* cost being £1,700. The shed, cleared of stalls, allowed a covered area of 45 square feet per cow, when numbers were increased to 100, with a loafing area of open yard also of 45 square feet per cow.

Two men are capable of carrying out all the work connected with 100 cows, whereas at the buildings half a mile distant where the traditional cowshed system was retained, 3 men were necessary to cope with the bucket milking and silage carting into the shed.

Table I gives the comparative figures for the year 1960 from data obtained from work studies and costing records.

TABLE I

	Self-feeding	Cowshed
No. of men	2	3
Average number of cows ...	97	70
Labour per cow (hours) ...	52.5	102.7
Annual milk sales (gall.) ...	79083	58865
Sales/cow (gall.)	817	835
Concentrated/gall (lb.) ...	1.16	1.69

The labour per cow on both systems compared favourably with "premium" standards obtained from other investigations. The concentrates fed to both herds consisted of 50 per cent. beet pulp and dairy cake and the ½ lb. less per gallon required by the self-fed cows was saved through self-feeding. The comparative costs of the two systems are given in Table II, labour and purchased food offering the greatest scope for economies. These two taken together show a saving of £17 per cow or 4.6d. per gallon in favour of the modern system.

TABLE II

	Self-feeding		Cowshed	
	Per cow £	Per gall. d.	Per cow £	Per gall. d.
Labour	12.76	3.75	26.51	7.64
Purchased food	12.70	3.73	19.07	5.48
Silage/hay ...	13.30	3.9	13.77	3.96
Bedding ...	3.93	1.15	0.34	0.10
	£42.69	12.54d.	£59.69	17.16d.

This is not a clear-cut comparison of ordinary shed silage feeding and self-feeding, but a full comparison of systems including milking and method of housing where the net cost of a conversion from a shed system to self-feed cost £17 per cow. Labour costs amount to approximately 20 per cent. of milk production, whilst food (including grazing) averages about 60 per cent. of the total cost. Any reduction in these two items can be of great importance in view of the trend for less favourable prices for milk.

(b) *Additional Quantity of Silage Needed for Self-feeding*

With unrestricted self-feeding an animal will consume daily 10 to 12 lb. of silage for each cwt. of live-weight. Cows need 1½ tons for each month of the winter and it is prudent to estimate for an early winter and a late spring. From the south to the north of the country, the winter requirements of silage, if no other bulky food is available, will be from 5½ to 8 tons per cow. This quantity may appal farmers who in the past have been hand feeding only 30 to 40 lb. to each cow. Once the quantity needed is accepted and the programme of grass production planned, the target is not difficult to achieve provided proper silage harvesting machinery is obtained. Even small farmers on 50 acres have forage harvesters and for those who do not wish to invest in such machines, it may be possible to employ a contractor.

With good grass swards and the use of leys and an intensive fertilising programme, 1½ acres of grass will provide grazing and grass for silage for self-feeding over the year.

Earlier attempts at self-feeding were not always satisfactory because of waste on the clamp and without the use of a barrier the animals wasted silage by trampling it under foot.

The Cost of Silage in Relation to other Foods

In the cost of making silage, the grass growing costs made up of rent, fertilisers, establishment charges, etc., and the harvesting charges are about equal. The all-in costs are about £2 per ton of silage made. To make good silage of around 15

per cent. crude protein, the grass growing costs of about £1 per ton are not too difficult to maintain, but to get it into the silo for another £1 per ton needs efficient organisation of both men and machinery. The advent of forage harvesters 4 years ago has taken most of the hard work out of silage making and large tonnages can be ensiled without any hand work except spreading on the clamp.

A Bristol University report quotes the relative costs for food per gallon of milk:—

Kale	...	5.6d. (Grazed)
Silage	...	6.7d. (Self-fed)
Cake	...	14.5d.

Kale has a little advantage over silage in cost, but its great drawback is the appalling conditions which cows have to withstand to get it and the foot troubles which develop. These costs suggest that the ideal combination for cheap winter milk production is some kale with as much reliance as possible on silage self-feeding and the careful use of starchy foods with dairy cake.

Health of Animals on Self-fed Silage

The effect of various methods of husbandry, types of housing, management and environment on animal health is often purely circumstantial. Because of this the alleged effects of the introduction of self-feed silage on animal health must be treated with reserve.

(1) *Acetonaemia*

Some farms state that since they started self-feeding their cows have not been affected with acetonaemia. Others who may be less successful in making silage with proper fermentation have cows affected with acetonaemia. The explanation is probably the high butyric acid and high moisture content of the poorly made silage: the butyric acid being ketogenic and the high moisture limiting the intake of nutrients.

(2) *Infertility*

On I.C.I. owned farms approximately 350 dairy cows have been self-feeding silage for 3 winters, and no serious cases of infertility have arisen. As an insurance, minerals are fed liberally including high phosphate supplemented with vitamin A and D. From our Grassland Management Investigation with over 80 co-operating farmers, half of which are self-feeding silage, come reports that since they began self-feeding, there has been an improvement in general health, increased fitness and absence of digestive disturbance.

Milk Quality

It has been suggested that liberal feeding of silage could lead to low milk composition and low solids-not-fat, in particular. This criticism of the feeding of relatively large quantities of silage was not borne out by the results of trials at the National Institute of Research in Dairying. These showed that heavy silage feeding could cause low solids-not-fat, only if the total intake of dry matter and starch equivalent was inadequate. When the dry matter and starch equivalent content of the ration was correct, no depression in solids was noted. When silage is hand fed often the quantity given is badly over-estimated, but with the greater intake by self-feeding there is less chance of an insufficient ration. Also the feeding of a high-starch concentrate ration in place of balanced cake, is in line with evidence regarding the importance of the energy value in maintaining solids-not-fat content.

Some Results of Self-feeding

(a) *Beef*

Experiments with self-feeding by fattening bullocks have been carried out at the Agricultural Research Institute, Hillsborough, Northern Ireland, over a number of years. In 1958/59 a comparison was made with long grass silage and forage harvested grass from the same field. Over a finishing period of 10 weeks the group of bullocks self-feeding long grass averaged 1.6 lb. live-weight gain per day, whereas those on forage harvested silage had a daily live-weight gain of 2.2 lb. Implantation with 45 mg. hexoestrol gave an additional live-weight gain of .4 lb. daily in each group without any ill effects. There was no difference in the killing out percentage on carcase quality. As with a similar trial carried out the previous winter, it was estimated that the consumption of forage harvested silage was 10 per cent. greater than that of long grass. It was easier to pull out, which accounted for the better live-weight gains. In another series of trials at Hillsborough carried out with fattening bullocks self-fed over 2 winters, silages of low and high dry matter content were compared. In both trials the higher dry matter silage gave the best live-weight gains amounting to an average difference of nearly 1 lb. per day for each animal. In these and other trials, gains of over 2½ lb. per day on silage self-fed have been achieved without any supplementary feeding.

(b) *Milk*

At the I.C.I. farm at Henley Manor, Crewkerne, Somerset, a high yielding herd of Ayrshires have been self-feeding for 4 years. The milk sales average per cow is 1,059 gallons on a concentrate ration of 1¼ lb. per gallon, half of this being barley and beet pulp. No concentrates are fed during the grazing season and in winter half of the milk is produced from silage. The feeding system is simple in that silage provides for maintenance and the first 2 gallons of milk. Starchy food only is fed for the third and fourth gallon, with dairy cake given to any cows producing more than 4 gallons.

The Behaviour of Cows on Silage Self-feeding

At Henley Manor in the winter of 1959/60, 17 cows self-feeding at one silo were observed continually (except during milking) for 3 days, and the individual behaviour of each cow was charted. Table III is a summary of the various activities.

The time spent at the silage face agrees with records reported from the National Institute of Research in Dairying, Shinfield, where the time each animal

TABLE III
PERCENTAGE OF TIME SPENT

Eating Silage ...	17.8
Eating Hay ...	2.1
Standing	34.7
Lying	45.4
	100.0

spent at the face was recorded photographically over a period of 5 days. The West of Scotland College of Agriculture found that, on average, each cow spends 22 per cent. of her time eating silage. About 3½ to 4 hours of the cow's day only is occupied eating silage at the face. From Henley Manor studies, the rather interesting fact emerges that the time spent standing loafing was 34.7 per cent. of the total time available. The following observations were also worth noting:—

1. Young cows made more visits to the silage than old cows, but their visits were shorter. The old cows often made fewer than 10 visits a day to the silage.
2. Old cows lay down as frequently as the young cows but they lay for longer and many had their own particular spot to lie on, moving off any intruder.
3. Over one-third of the day was spent cudding and nearly two-thirds of the cudding period was when lying.
4. One cow was a persistent bully.
5. The busiest time at the face was between afternoon milking and midnight, and visits to the face were least frequent between midnight and morning milking.

The Rôle of Silage Self-feeding

Silage making is complementary to proper grass utilisation. Good grass is the cheapest and best food for cattle, and if grass were available all the year round, feeding of stock would be a simple matter. The extension of the grazing season both in spring and autumn by the use of quick-growing short-term ryegrass, and with the suitable use of fertilisers, can do much to shorten the winter. Providing a continuous supply of quickly grown grass throughout the season leads to a surplus in the flush periods of growth. In order to maintain grass of first-class quality for grazing, this surplus must be cut for silage before it becomes mature and to allow a succession of crops of good quality for later grazing.

With intensive stocking either by paddock or electric fence, strip grazing, soiling by dung and urine prevents proper utilisation in successive grazings. By taking cleaning cuts for silage, the following crops of grass can be fully utilised.

Grass silage provides starch equivalent at little more than twice the cost at which grazing provides it, whereas as a source of starch equivalent, purchased concentrates are about 2½ times more expensive than silage.

Experimental evidence supported by farm experience shows that good quality grass silage is capable of supporting maintenance and the production of at least 2 gallons of milk daily, and of producing live-weight gains of more than 2 lb. per head daily in fattening cattle. Hay commonly made in this country, will scarcely provide maintenance requirements. Consequently the self-feeding of silage permits a substantial saving on the cost of imported concentrates in the overall costs of milk and beef production. This saving of concentrates coupled with the saving of labour provides a system which can help farmers to face the future with confidence.

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3.—The Zero-grazing of Dairy Cows

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SUMMARY.—Modern methods have renewed interest in zero-grazing or soiling of grass to cattle housed in yards during the summer. The advantages of zero-grazing are the improved utilisation of grass, less wastage, lower labour and fencing requirement than grazing cattle. The disadvantages are the machinery and labour required to cut and cart the feeding and the bedding cleaning of the yards.

Trials at the Edinburgh School of Agriculture showed an increased cow-carrying capacity of 12 per cent. over a number of years. A subsequent trial showed no difference in milk yield between grazed and zero-grazed cows. The intake of feed of the cow is given and no difference in the quality of milk was observed. The breeding performance of the cows on zero-grazing tended to be slightly better than those on strip-grazing. Disease problems were similar in both groups of animals except in the case of foot troubles. The zero-grazed animals showed a complete freedom from these troubles. The author discusses the place for zero-grazing in farming systems.

ZERO-GRAZING is the cutting and carting of grass for feeding to stock housed in a shed or yard. Modern techniques of production and mechanisation have renewed interest in the practice. The introduction of the forage harvester and the desire for improved utilisation of grassland are the two main factors responsible.

The advantages of zero-grazing may be summarised as follows:

1. Improved utilisation of the grass as the wastage of grass through trampling and fouling by the grazing animals is avoided. This results in a higher stocking rate per acre.
2. Better control over feeding as the quantity and of material fed can easily be altered.
3. The whole farm can be used for dairy cows so that inaccessible fields are grazed.
4. No fences or piped water are required.
5. No labour is needed to move cows back and forward to the grazing.

The disadvantages are:

1. Increased costs for machinery and labour to cut and cart grass.
2. Increased labour to tend and clean the cows and the yards.
3. Increased bedding requirements.
4. Greater reliance on machinery to feed the cows.

The cutting of grass for feeding to cows was practised over 100 years ago in this country. During the latter part of the 19th and the early part of this century it was widely carried out in "town" or "dry" dairies. The increased premium received by these milk producers made this an attractive proposition. Rising costs, and the introduction of the Milk Marketing Board which removed this premium to the producer-retailer made it less attractive financially. It is still, however, widely practised in Southern Germany, Switzerland and the western states of the U.S.A.

The earliest reference to zero-grazing is in a paper by Caw (1812) which deals with cows zero-grazed on clover on a farm in Perthshire from mid-June to mid-September. Advantages claimed for zero-grazing were:

1. A large and profitable stock of bestial was kept at comparatively small expense.
2. An extra supply of rich manure was obtained.
3. Pasturage, on a farm ill adapted for it, was dispensed with.
4. Having one half of the farm in white crop gave a better return and more ample means for the production of manure.
5. The land was kept clean and in good heart by a rigid system of cropping, and by introducing a fallow.

Adam (1851) carried out a trial comparing soiling and grazing of beef cattle. He found a greater intensity of stocking and a higher return from the supplemented cattle.

In the U.S.A. reports of early work go back to 1820 where work by Quiney and Otis quoted by Henry and Morrison (1923) showed a considerable saving in acreage when cattle were zero-grazed as compared with pasturage. Peer (1881) wrote a book on the subject, and while mentioning the saving of fencing stressed the loss of potential nutrients caused by cattle trampling or lying on the herbage; he made the point, too, that selective grazing by stock leaves the pasture progressively less valuable. This finding is confirmed by Grandjean (1937) in Switzerland who found the utilisation of starch equivalent by grazing animals to be 48 per cent. and 55 per cent. in 1930, and 1931, although by improved management this was increased to 78 per cent. and 66 per cent. in 1934 and 1935.

The majority of work on soiling has been done with grass but Brown (1920) working at Harper Adams College used green-cut arable crops. Leeds University (1925) published results of 4 years' work with soiling on arable crops on a farm in Yorkshire. The production results were good but costs were higher than grazing.

The recent work on zero-grazing has been done in the U.S.A., Israel and Great Britain. In California, Ittner *et. al.* (1954) working with beef cattle on lucerne, compared rotational grazing with strip green soiling and soiling with wilted herbage. Green soiling showed a relative value of 169, strip-grazing 139 and rotational grazing 100. Wilted green soiling gave curiously low values. In subsequent experiments by Meyer *et al.* (1956) wilted lucerne was replaced by feeding hay. Strip-grazing in these trials gave little advantage over rotational grazings; feeding hay gave better results and soiling still better. Stone (1959) reviewing the practise of soiling in the southern states of the U.S.A. shows variable results. Data from Louisiana reported that 400 lb. more milk was obtained per acre from grazing. Trials in Tennessee showed an increase of 123 per cent. milk by soiling. Owen *et al.*, in Mississippi found soiling to have a 9 per cent. advantage over strip-grazing and one of 47 per cent. over rotational grazing. Work at Beltsville and Tennessee showed no advantage from zero-grazing.

Larsen (1958) at Wisconsin showed that stored feeding produced more milk per acre than green feeding or strip-grazing. Kennedy *et al.* (1959) showed over a 3-year period that 6-paddock grazing was preferable to strip-grazing or zero grazing methods. Zero-grazing was superior in the first year, slightly better in the second and markedly inferior in the third year. In Israel, Arnon (1960) suggests that where pasture grasses and plants are highly productive then grazing has all the advantages. Where forage crops not adapted to grazing are inferior then zero-grazing would be of advantage.

Logan *et al.* (1960) showed no difference between strip-grazing and mechanical grazing. The cost per cow per day was 13 cents for zero-grazing and only 3 cents per cow per day for grazing.

Over the past 5 years zero-grazing has been studied at the Edinburgh School of Agriculture. Two herds of 40 to 50 Ayrshire and Friesian cows were used. The zero-grazed group were housed in a semi-open loose-housing yard. The strip-grazed group was milked in a cowshed and grazed over pastures which were alternately cut for silage and grazed. This considerably reduced the refusal of grass due to contamination. The electric fence was moved daily and so the selectivity of grazing by the cows was reduced. This differs from extensive grazing where the grazing animal can exert a considerable selection on what it grazes. In zero-grazing selection is considerably limited and ensures that a more uniform feed is made available to the cow. The zero-grazed animals were

fed grass twice a day at 8 a.m. and 2 p.m. Concentrate supplementation was limited to the early part of the season and to late summer-calving cows. Table I shows the results for the whole herd.

TABLE I
PRODUCTION OF MILK FROM STRIP-GRAZED COWS—WHOLE HERD

	Strip-grazed		Zero-grazed	
	1957–8	1959	1957–8	1959
Average number of cows milked	36	39	36	45
Length of period in days	170	147	170	147
Milk production per cow per day in lb. ...	23·6	29·1	18·8	24·0
Acreage required per head	0·77	0·95	0·70	0·66
Milk production per acre in lb.	5,275	4,490	4,782	5,388
Grazing days per acre ...	225	175	243	214

Stocking Rate Per Acre

The stocking rate per acre was increased by 12 per cent. on the average; the average number of cow-grazing days per acre shows an increase from 220 to 245. A cow was carried for the summer period of approximately 160 days on 0.86 acre for strip-grazing and 0.68 acre for zero-grazing. The cows were fed *ad lib* and no restriction was practised. Table I shows the intake of the animals. It is possible that some restriction of intake could be practised for lower-yielding animals without affecting yield. This would increase the stocking rate per acre. Where a high yield was being maintained the restriction of intake would not be possible.

Milk Yield Per Cow

In the trial with the 2 herds of cows it is difficult to assess the effects of zero-grazing on yield. Table I shows a similar production per acre. Table III shows that the persistency of yield has been the same with zero-grazing and strip-grazing. A subsequent trial conducted on a smaller group of animals showed no difference in the milk yield between cows strip-grazed and cows zero-grazed. It would appear that, provided the cows zero-grazed are given sufficient suitable grass, the yield of the individual cows should not be affected. The ease of accessibility to the feeding troughs is important in this respect. No physical restriction such as shortage of trough space, overcrowding or lack of storage in the trough should be present to reduce the animal's intake.

Lactation yields of up to 1,750 gallons and average lactation yields of 1,100 gallons from mature Friesian cows are obtained from this herd. The persistency of lactation in both groups of animals was the same, the mean daily yield being 67 per cent. of the initial yield in the lactation.

Intake Per Cow

Table II shows the intake per cow. This is less in 1957 and 1958 than estimates from grazing. However, the 1959 figure is much higher. This difference is probably due to the difference in D.M. per cent in the grass in 1957 and 1958 compared with 1959 which was a much drier year.

TABLE II
FEEDING VALUE OF GRASS STRIP-GRAZED AND ZERO-GRAZED

	Strip-grazed			Zero-grazed		
	1957	1958	1959	1957	1958	1959
Dry Matter (D.M.)%	19·7	16·9	24·5	18·2	16·9	24·3
Starch equivalent in the D.M.) ...	58·4	59·9	59·1	58·3	58·3	57·2
Digestible crude protein (in the D.M.)	10·8	12·7	11·6	12·3	11·3	9·0

MEAN DAILY INTAKE BY ZERO-GRAZED GROUP (LB/COW/DAY)

	1957	1958	1959
Fresh grass	145	137	151
Dry matter	26·4	24·6	35·3
Starch equivalent ...	15·4	13·4	20·3
Digestible crude protein	2·9	2·2	3·1

As mentioned above, intake can be affected by physical factors in housing but the presentation of grass can influence this also. The contamination of the grass during cutting will lead to a serious reduction of intake. Normal operation of the flail-type harvester will not cause contamination affecting intake as compared with long grass. However, if the rotor is grounded, causing soil to be mixed with grass, then a considerable reduction in intake is possible. It is essential that the machine is correctly set and operated. There is no evidence that the shredding of the grass by the harvester affects intake.

Quality of Milk

The quality of milk produced is given in Table III and no significant differences are noted. The level of solids-not-fat and butterfat percentages can be considered satisfactory despite the very limited concentrate supplement given. There is no evidence that despite the low intake of dry matter this has affected milk quality. Any serious nutritional deficiency would be reflected in the solids-not-fats fraction.

Breeding Performance

The breeding performance of cows under zero-grazing was slightly better than those under the strip-grazing system. All breeding was done by artificial insemination. Table IV shows the results for the years 1957, 1958 and 1959. The housing of cattle in a loose-yard where they are more easily observed would account for some of this increase. The low figure of 56 per cent. in 1958 was due to 2 cows being difficult to breed. The conception rate was raised to 82 per cent. on the second service. There is no truth in the belief that zero-grazed cows breed less well than those grazing on pasture.

Clinical Troubles

Various disorders occurred during the period but apart from foot troubles zero-grazing animals were no more prone to disease. The feet of the animals on zero-grazing were in perfect order due to the effect

TABLE III

PRODUCTION OF MILK FROM STRIP-GRAZED AND ZERO-GRAZED COWS—SELECTED GROUP

	Strip-grazed		Zero-grazed	
	1957–8	1959	1957–8	1959
Number of cows	17	14	17	22
Length of period (days)	170	147	170	147
Total milk production (lb.)	98,555	76,974	80,254	99,105
Concentrates fed (cwt.)	42	2·5	14	—
Milk from grass (lb.)	82,161	76,212	74,600	99,105
Average production per cow per day (lb.)	27·9	37·0	23·7	30·9
Butterfat (%)	3·79	3·82	3·83	3·77
Solids-not-fat (%)	8·80	8·78	8·84	8·76
Initial yield (lb.)	50·3	57·2	40·0	45·0
Persistency of initial yield (%)	67·2	65·3	68·8	68·5
Initial liveweight (lb.)	1,095	972	1,193	1,016
Increase in liveweight (lb.)	114	133	142	168

TABLE IV

BREEDING PERFORMANCE OF COWS

	Number of cows served		Per cent conception at 1st service	
	Strip-grazed	Zero-grazed	Strip-grazed	Zero-grazed
1957	21	14	67	72
1958	20	17	56	82
1959	21	19	61	70

of the concrete. Lameness was fairly common in strip-grazed animals. In young stock and beef cattle kept in fully-bedded yards bad feet resulted. Long, soft horn produced in the feet appeared to result in misshapen feet at an older age. Metabolic disorders such as hypomagnesemia were recorded in 1956, equal numbers of cows on strip-grazing and zero-grazing. In latter years no cases have been found despite the use of intensively manured grass. Since 1957 pastures used for grazing have been treated with 2 cwt. calcined magnesium sulphate per acre. Damage to the hind legs and pelvic girdle, due to slipping by animals new to the concrete, occurred in 1957 and 1958. In 1959 this small area of the concrete yard was roughened and no further difficulty occurred.

The animals zero-grazing put on more liveweight during the summer months than those going out to grass.

Bedding

Cows housed during the summer require bedding so that the requirement for the year is more than double during the normal season. The daily requirement was 11 lb. straw per cow. This means an additional 16 cwt. per cow per annum as no bedding is required for animals grazed during the summer.

Costs

The cutting and carting of grass obviously increases the cost of feeding the cows. Some savings occur in that no fencing costs are necessary and no labour is required to move cows to the fields. The latter job may take 1 to 1½ hours per day in extreme cases. Table V gives a cost of operation for 45 cows. This shows a net cost per cow of £8 18s. If the value of the F.Y.M. produced is deducted then the net cost of zero-grazing is £6 8s. per cow, this represents a cost of 9d per cow per day.

The increased production of F.Y.M. will be an advantage on an arable farm where it can be utilised on arable crops. On predominantly grass farms the need for F.Y.M. is much reduced. It would also appear that the fact that animal residues are not returned to pastures does not affect the production of dry matter from areas where the clover contribution

TABLE V

DAILY COST OF ZERO-GRAZING OVER STRIP-GRAZING 45 COWS FOR A SEASON OF 180 DAYS

	£	s.	d.
GROSS ADDITIONAL COSTS			
Machinery			
Forage harvester @ 2s. per ton of grass ...		6	–
Tractor : 2 hours @ 3s. per hour		6	–
Trailer			6
Labour			
Feeding : Tractorman for 2½ hours @ 4s. per hour		10	–
Cleaning and bedding : 1½ man hours ...		6	–
Bedding Material			
Straw : 5 cwt. @ £5 per ton	1	5	–
	£2	13	6
DEDUCTIONS			
Electric fencing costs @ £10 per annum ...		1	–
Labour saved in moving cows and fences ...		8	–
		9	–
NET ADDITIONAL COSTS			
Per day for 45 cows	2	4	6
Per cow for season	8	18	–
Per season for 45 cows	400	10	–

to the sward is high (Herriot *et al.* 1959), so that the dung can be reserved for use on high-return crops.

The cost of operating a zero-grazing system depends on:

1. Number of cows.
2. Method of operation.
3. Extent to which machinery is used for other purposes.
4. Amount of labour required.
5. Importance of grass as a milk-producing food in the feeding regime.

The justification for the increased costs depends on the use made of the land saved by zero-grazing. If it is utilised by high-return cash crops or additional dairy cows then the practice is economically sound. If, however, it is utilised by low return crops such as cereals then it is questionable if it is economic.

The Place of Zero-Grazing in the Farm Economy

Zero-grazing has resulted in an increase in production per acre under British conditions. The increases achieved at Langhill Farm are such as can easily be achieved by the use of more conventional and easily adopted techniques. The improvement and intensification of grass can, on the average, yield better results. It is possible that on many farms increase in production from grass by improved conventional methods would be greater than achieved above. The strip-grazing management was of a high order and the possibility of improvement was less than average. Zero-grazing also goes against the trend in the majority of farming systems which is towards simplification. Zero-grazing intensifies the system and can complicate it.

Experience would suggest that the advice to the majority of farmers is to improve the normal grazing management by good mixtures, more fertiliser and better management. There are, however, specific instances where zerograzing has a place in the farming economy:

1. *Large Herds*

On large dairy farms the management of pastures within easy walking distance of the milking point is often difficult. Milk yields are likely to suffer where cattle, particularly older animals with bad feet, have to walk long distances to a "day" pasture. But machinery is likely to be available for cutting and carting the feed, and with a large number of cows the most efficient use can be made of this investment.

2. *Intensive Grass Management*

Where high yields of milk per acre are being obtained by conventional methods, further increases may be difficult to achieve. Zero-grazing, however, is a likely way of increasing production, whether the herds be large or small.

3. *Shortage of Grass*

Since zero-grazing gives complete control over the material fed to the cows, grass of high quality can be rationed out to animals whose milk production does not warrant a full intake. Accurate supplementation with concentrates is made more easy and with a saving of grass by the grouping of cows at different yield levels. In areas where bloat is prevalent, feeding of the dangerous herbage can be restricted and clinical cases avoided.

4. *Unsuitable Grazing Conditions*

Under wet conditions which do not allow the best use to be made of pasture by the grazing animal, machines will do less damage to the land than cattle. When fields cannot be used by the milking herd owing to distance from the buildings or the presence of main roads, cutting and feeding of the grass will allow them to be used by the most profitable type of stock-milking cows; the additional animal residues can be applied to these outlying fields, so that fertility is carried all round the farm and a system of ley-farming can be practised. Similar benefits are brought to land where lack of fences and piped water preclude grazing.

In areas where pasture production is liable to drop owing to unfavourable climatic conditions at certain times of the year, supplementary crops not suited to the grazing habits of animals can be used as succulent feeds, *e.g.* lucerne, vetches and maize. In the U.S.A. where climatic conditions are more extreme than in Britain, crops of this nature are grown in rotation for cattle feeding. A recent development in the U.S.A. has been the use of silage as a succulent feed all the year round, no fresh green feed being given at all; this avoids any changes in feed and allows freedom to concentrate on the rapid ensilage of crops at the correct stage of growth.

5. *Beef Cattle*

On many farms young cattle of 6 to 15 months do not thrive well because pastures are wet and lush and climatic conditions are unfavourable. Housing of these cattle can then improve liveweight gains. Beef animals that are not finished by the end of the winter can be housed for a further period and fed grass, so reducing, perhaps, the check that animals receive on being turned out to graze and allowing them to be marketed when beef prices are high.

Results from America indicate that production per acre is higher when grass is fed than when it is grazed, though the individual gains were not significantly greater (Ittner *et al.*, 1954).

With beef cattle, the liveweight increases achieved can be cashed whenever prices are favourable, whereas milk has to be sold in summer when the lowest prices are ruling.

To sum up, the practice of zero-grazing has many advantages to offer in the feeding and management of both dairy and beef cattle and, when used with the correct machinery and building lay-out, can increase production and financial returns in various farming systems.

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The Speakers' Introduction

The Chairman, Mr. R. M. Loosmore, said that the Session was something in the way of an innovation at the British Veterinary Association Congress. Agriculture was expanding and changing so rapidly these days that the profession had, on occasion, been caught short by developments in animal health arising from developments in general agriculture. It was therefore thought proper to arrange a Session on some of the newer methods being used in agriculture which might have veterinary implications in the future.

There were 3 speakers on the subject: Dr. Colin Spedding, whose interest was the animal in relation to its environment, particularly grass. He came from the Grassland Research Institute. He had a lot of ideas about the future of fat lamb production, and his early weaning of lambs was something which might become quite important in the future. Mr. R. R. Turner was the Farm Manager for all the farms owned by I.C.I., a total of about 5,000 acres. Those farms included experimental farms, investigational farms and straight commercial farms. He had been a pioneer in silage self-feeding and that method of feeding was very widespread over the country but was destined to become wider. A very welcome visitor from Scotland to Oxford was Mr. K. V. Runcie from the Edinburgh School of Agriculture, where he was Lecturer in Animal Husbandry. He had devoted a lot of time to the experimental zero-grazing of dairy cows.

The papers would be taken altogether, followed by a general discussion. He suggested that, in that general discussion, they need not confine themselves to those 3 subjects, because the 3 experts together could deal with a lot of other methods of modern feeding.

Dr. C. R. W. Spedding said that a debt of gratitude was owed to Mr. Loosmore and other veterinary colleagues for their co-operation in the work described in the paper.

In the paper on the early weaning of lambs, some pains had been taken to make a fairly cautious assessment of what was, after all, at this stage, only a possibility as far as practice was concerned. In fact the situation was probably more promising than had been made out in the paper, but it was so often the case that a research worker, who simply thought a topic worthy of investigation, was considered to be advocating the particular thing he then talked about. He and his colleagues in no sense advocated, at this stage, the early weaning of lambs, and the only sense in which they might be said to advocate it was that practically anything one did in agriculture could be advocated in the appropriate circumstances. The application of agricultural research depended on a definition as to where a particular method of husbandry was or was not appropriate.

With that background, he wished to make the introduction to the paper a somewhat more optimistic version because it was important that the veterinary profession should be aware of the possibilities; whether in fact all those possibilities were realised or not, it could not but be better to be aware of them well in advance because they carried considerable implications to the veterinary profession; it was possibly unnecessary to point out that those possibilities existed whether they were approved of or not.

The reasons for the early weaning of lambs were many and varied, but they really all boiled down to the fact that it made biological sense to wean lambs early when the ewe could not fatten them all by herself. He put it that way because, in agricultural terms, it was necessary that the ewe should fatten her lambs and not merely rear them, and the ability of the ewe to do that was largely dependent on the milk supply being adequate for the number of lambs supported by one ewe. That was not simply a matter of the genetic potential of the ewe for milk production: the reference here was milk production of the ewe within the context in which she was expected to perform. That context included management and nutrition, stocking rate, lambing percentage, etc., and while a given breed of ewe might be perfectly capable of supplying the milk necessary to fatten 3 lambs in some circumstances, at a different stocking rate, level of nutrition, etc., she might be able only to fatten one.

The reasons for early weaning—mainly too little milk or too many lambs, or a combination of the two—had to be borne in mind. It was necessary to define early weaning because, strictly speaking, weaning was a process during which the young animal learnt to take food other than its natural milk supply. That was a rather difficult definition to use because one tended at some times to talk about weaning as part of the process, and at others when one really meant the termination of that process; therefore, for the purpose of the paper, early weaning was defined as the cessation of liquid feeding at a stage when milk was normally a major constituent of the diet.

He would first consider what was known about early weaning so far.

The growth rates shown on the first slide were based on data derived from an early weaning experiment where ewes and lambs were stocked at a stocking rate of 6 ewes to the acre, and all the lambs, whatever their early weaning or other treatment, were exposed to the same parasitic infestation on the pasture. It would be seen that the growth rate of the normal single lamb was high and the growth curve virtually linear. That of the normal twin lamb in the same circumstances showed a distinct curve and a considerable falling off in growth rate at about 70 lb. live-weight. Twins took considerably longer to fatten than singles.

In addition to those, there was, in the experiment, another group of ewes all of which had twins at birth; these were allowed to suckle the ewe for 3 weeks, then one member of each twin pair was weaned abruptly, by removal from the ewe, and put on to grass alone at that age. The lamb left behind on the ewe, reared as a twin up till then, grew substantially like a single on the extra milk supply left to it upon removal of its mate. Born as a twin but given the milk supply of a single from 3 weeks, the performance was, broadly speaking, that of a single. Milk supply was the key to the growth rate.

A lamb weaned abruptly at 3 weeks of age underwent a period of check to its growth rate but eventually overtook the normal twin lamb reared at the moderately high stocking rate. That was not to imply that twin lambs could not do better than that. It could be seen that there was apparenly some merit in early weaning in that half the twin lambs went off as singles and the other half did at least as well as twins.

Another slide showed the number of roundworms in the guts *post mortem*. For normal single lambs, with a growth rate of 0.72 lb. per day, the number of worms was small: it tended to increase as the milk supply got less. Twin lambs reared as singles at the same stocking rate as previously described gave a growth rate similar to that of normal singles and only a slight increase in number of worms.

When the artificial singles were very much more heavily stocked, the growth rate was depressed slightly and the roundworm burden increased, but nothing like to the extent found with normal twins. That was a typical picture for early weaning procedures carried out at Hurley. Milk supply was found to be the most important determinant; as the milk supply got lower, the growth rate went down. Associated with that, a higher worm population was found *post mortem*. If any such association was general, it should be remembered that early weaning put a lamb entirely on to grass at a very early age with an even lower milk supply than any normal twin or triplet and it seemed to him that, even where early weaning procedures were shown to be satisfactory, it had to be borne in mind that the lamb was now a grass-eating animal at a very early age and this would involve a greater risk of serious parasitism than would be the case with suckled lambs. It would seem therefore that in early weaning procedures particular note should be taken of that and systems of management developed to control parasites.

While it was possible to wean lambs on to grass alone as early as 15 days, that did not seem to be the best time to do it; about 3 weeks seemed to be the optimum, but it might be better to judge optimum weaning time by weight rather than age. If a figure had to be put to it, he would say between 25 and 30 lb. live-weight.

To come to the other part of the paper, in artificial rearing the lamb was removed at birth or very shortly afterwards, and that would be necessary where a ewe, for one reason or another, could not rear any of the lambs

she had produced. That would be so if the litter size were increased by hormones, or some other method, to very large numbers, or where it was desired to mate the ewe immediately after she had lambed, to produce two crops a year. Those were procedures being given a great deal of thought, and many people were rearing lambs artificially.

The authors were at a disadvantage in putting a paper together, because they were aware that many research workers up and down the country were rearing lambs artificially in large numbers; this was being done primarily as a means to an end, for some other purpose than a study of artificial rearing; the result was that the evidence available was not always published. They would have to rely chiefly on their own studies.

It was clearly necessary that colostrum should be fed to the lamb that was to be artificially reared; at the moment, it seemed sensible to leave the lamb on the ewe in order that it should get a supply of colostrum.

The growth to be expected during artificial rearing procedures was difficult to estimate. The conclusion was that if enough milk or milk substitute was fed to a lamb removed from the ewe virtually at birth, or 1 or 2 days after birth, the growth rate could be as high as that of a lamb suckling the ewe. A growth of 0.8 lb. per head per day for the first 5 weeks had been achieved where milk substitute had been fed *ad lib.* to such lambs. That was a very high growth rate and equivalent to that of the best average singles in the field, but it was an uneconomic level of feeding, because milk substitutes were very expensive. Broadly speaking, the growth rate to be expected on artificial rearing was largely dependent on the amount of milk fed.

The methods they had adopted and described in the paper for artificial rearing were their own and did not pretend to be anything like the best way of rearing lambs. They were not to be taken as their considered opinion and it was not implied that they could not be improved upon.

Particular attention had been given to the sort of problems encountered during artificial rearing, and causes of loss had been put in the paper. They might be summarised as, total losses from all reasonable causes, 8 to 14 per cent. death rate of the lambs they had started with. That was probably no higher than the loss under field circumstances where lambs were suckled, but the reasons for the losses, of course, were entirely different.

The paper finished with a choice of methods for artificial rearing whereby a lot of milk was fed for a short time or a little for a long period; that was the limit of the choice. A lot could not be fed for a long time for simple economic reasons, and a little could not be fed for a short time for biological reasons.

The next slide illustrated what, to some people was an extraordinary level of milk intake for quite small lambs; they were Dorset Horn and Welsh Mountain lambs. The number of pints per day per head was quite extraordinary, and probably the biggest error in artificial rearing in general was to feed too little. Watering down cow's milk equivalent was even worse. What was being fed was a strength and a half of cow's milk equivalent, that is 1½ lb. per gallon of the sort of milk substitute powder that would be used for calves at 1 lb. to the gallon; therefore, 6.8 pints per head per day was equivalent to about 10 pints of cow's milk, for lambs 5 weeks of age. It was at that sort of level that the growth rate of 0.8 lb. per head per day was achieved.

The best age to wean artificially-reared lambs could not yet be given but the earliest age was much the same as that for direct weaning, between 2 to 3 weeks. It seemed pointless to wean a lamb off the ewe and rear it artificially if the ewe could support it for 2 or 3 weeks, because it could be weaned off the ewe at that age without any further milk feeding. Artificial rearing was required only if the ewe could not feed the lamb for even 3 weeks, though it might be desirable for special purposes to rear artificially even when this was not essential.

With regard to future possibilities and the question of increased litter size, one of the major objections to any increase in the litter size of sheep in the past had, of course, been that the ewe's milk supply could not keep pace. The procedures described could leave us independent of the ewe for the purposes of rearing lambs, so as many lambs per ewe as possible could be produced without worrying whether the ewe could rear them or not. This had to be considered because the biological efficiency of lamb production was much governed by the lambing percentage. The ewe having to be fed the whole year round, the more lambs she produced per year, the lower the proportion of food used for maintenance. By increasing the number of lambs per ewe, one shifted the food demand from the wintertime when it was scarce and expensive to the summer period when it was plentiful and cheap. One could then visualise various degrees of separation of ewes from their lambs from a practical point of view. One could visualise intensive ewe flocks on the hills and lambs reared intensively on the lowlands.

Slides were then shown which illustrated the last point in connexion with the rearing of Welsh Mountain lambs. Either procedure, early weaning or artificial rearing, could produce perfectly satisfactory carcases, but he would not wish to give an impression that either procedure was without its problems.

Mr. R. R. Turner said that many good things in farming and, indeed, scientific discoveries, had happened by chance and he thought that that was the way that silage self-feeding began. Most attention was devoted to the dairy cow, and self-feeding was becoming very popular with dairy farmers, but there was also information on self-feeding beef cattle, nurse cows, cows with calves, and even sheep. The practice had been very satisfactory except where the total daily intake of nutrients was inadequate, often due to too great a height of silage and to over-consolidation. There was no trouble with teeth but young cattle, when changing teeth, might have to be taken off the silage for a period.

The quality of silage depended on 3 main factors which were inter-related: stage of maturity of the grass, dry matter content of the grass when cut, and the type of fermentation in the silo. The less mature the grass, the higher would be its protein content and digestibility; the higher the dry matter content, the more concentrated were the nutrients in silage provided that the higher dry matter was the result of wilting rather than cutting at an advanced stage of maturity.

The type of fermentation was believed to be improved by chopping and laceration. Spring silage, if the fermentation was good and the dry matter content reasonable, gave best results both in milk and beef production because of the higher sugar content of the herbage.

Self-feeding would not work well unless there was a good layout. One of the essentials was that silage must be on concrete and that concrete had got to be cleared up daily. Some people were now putting silage on slatted floors and that might solve the problem of daily cleaning. A roof was necessary to keep water off the silage in winter-time and it protected the cattle. Young cattle would only eat up to 5 feet but cows up to 7 feet. Some form of barrier was necessary to keep them from burrowing holes, otherwise they might disappear.

The most obvious advantage of self-feeding was the saving of labour. A survey carried out in 1953 of 50 farms showed that to cut out of the clamp, cart and feed the stock took 94 man minutes per ton. Adding to that, tractor charges, one might have a charge of 15s. a ton to move it.

The attraction was the quiet contentment of the cows. By being able to eat when they liked, they were much more content, and in the winter, it was amazing how they fleshed up.

One of the major obstacles to silage making was the smell which was clinging and caused farmhouse complaints. With self-feeding there was virtually no smell because only the face of the silage was exposed. Milk from individual cows which were feeding immediately before milking had been found to be tainted but that could be avoided by closing the cows off from the silage face for an hour before milking. That could not be recommended at half past 4 or 5 in the morning.

The saving of concentrates was considerable because with really good quality silage, from 90 to 100 lb. provided sufficient protein for maintenance and the production of 4 gallons of milk. The starch equivalent content of silage was lower in comparison with protein and starchy food was required after 2 gallons. Dairy cake could be

substituted by barley or beet pulp and that could amount to a considerable economy in the cost of supplemental food per cow in the winter.

Another useful thing about self-feeding was that it allowed gradual changes in grazing. It was possible in the autumn to bring the cows in after evening milking for an hour at first, and later allow them longer at the silage over a week or more before they were kept in all night. In spring, they could be let out to grass for an hour, go back to self-feed, and the grass was gradually extended until they were out full-time. That meant that there were very slight changes in milk yields and few digestive and nutritional upsets.

The main disadvantage of self-feeding was the capital required to provide the proper building layout. That varied according to the existing buildings on the farm. In his case, a shed on a Cheshire farm, with stalls for 70 cows, had been converted to loose lying, silage self-feeding, a milking parlour being installed; a Dutch barn was added nearby and the net cost was £1,700. The number of cows had been increased from 72 to 100 and the labour, food and milk from that herd was compared with another on a farm a quarter of a mile away, where the cows were maintained on the normal cowshed system.

It was shown that with self-feeding, two men were able to look after 97 cows and 3 men were required for the 70 cows in the shed. (See Table I in the paper.) Labour, man hours per cow, at 52.5 for self-feeding was nearly doubled at the cowshed. Concentrates per gallon were very low in both cases, being 1.69 in the cowshed and ½ lb. less on the self-feeding system. That was quite a low rate of concentrates for the milk yield of 817 to 835 per cow. The comparative costs of labour, purchased food, home-grown food and bedding, taken together, produced a saving of £17 per cow, or 4s. 6d. per gallon for cows on self-feeding.

The milking comparison was not clear-cut as to self-feeding and hand-feeding, but gave the relationship of self-feeding if given its best chance. Labour costs amounted to 20 per cent. of milk production, while food, including grazing, averaged 60 per cent. Any reduction of those two items could be of great importance in view of the trend of a less favourable price for milk.

The extra quantity of silage required for self-feeding put some farmers off. Depending on the length of the winter, a cow would need from 5½ to 8 tons. With the proper grass production programme and the use of silage harvesting machinery, it was not difficult to get that amount.

With good grass swards and the use of leys and an intensive fertilising programme, 1½ acres of grass would graze a cow and provide silage for self-feeding in the winter.

With regard to the cost of silage in relation to other foods, good silage would cost about £2 per ton. Bristol University had quoted figures of cost per gallon of milk, which were, kale at 5.6d. per gallon, grazed, which was a little better than silage at 6.7d., whereas concentrates were 14.5d. per gallon.

With regard to the health of animals on self-feed, the effect of various methods of husbandry, housing, management and environment on animal health was often purely circumstantial. Because of that, the alleged effects of the introduction of self-feed silage on animal health had to be treated with reserve.

On the question of acetonaemia, some farms said that they had not had it since self-feeding; some said they had. The explanation was probably poorer silage for those who had a lot of acetonaemia. High butyric acid and high moisture of low dry matter silage limited the intake of nutrients.

There had been no serious infertility problems on I.C.I. farms but they fed liberal minerals as an insurance, including high phosphate and vitamins A and D.

It had been said that liberal feeding of silage could lead to low milk composition and low solids-not-fat. Trials had not borne that out, although where the total intake of dry matter and starch equivalent were inadequate caused low solids-not-fat. When the dry matter and starch equivalent content was corrected, no depression in solids resulted.

A great deal of work had been done with long grass silage and forage harvested grass from the same field. Bullocks on forage harvested silage had a daily live-weight gain of 2.2 lb. with no supplemental food whatsoever.

At the I.C.I. farm in Somerset, a high yielding herd of Ayrshires on concentrates of 1¼ lb. per gallon on average produced a sales average of 1,059 gallons. Half of the concentrate ration was barley and beet pulp.

The behaviour of cows on self-feeding was studied and Table III of the paper showed that nearly 17.8 per cent. of the cow's day was spent actually at the silage face, or 3¼ to 4 hours. The point that came out of the study was that the old cows lay down as frequently as young ones but for longer. The busiest time at the face was between afternoon milking and midnight. Cows did not move around much, and few ate from 12 o'clock to the morning milking.

Silage making was complementary to the proper utilisation of good grass. Good grass was the cheapest and best food for cattle. Providing a continuous supply of quickly grown grass throughout the season led to a surplus in the flush periods of growth. To maintain grass of first-class quality for grazing, the surplus must be cut for silage before it became mature; then there was a succession of good-quality grass to follow on for grazing. With intensive stocking soiling prevented proper utilisation in successive grazings.

Grass silage provided starch equivalent at little more than twice the cost at which grazing provided it. As a source of starch equivalent, purchased concentrates were about 2½ times more expensive than silage.

Experimental evidence quoted from farm experience showed that good-quality grass silage was capable of supporting maintenance and the production of at least 2 gallons of milk daily, and of producing live-weight gains of more than 2 lb. per head daily in fattening cattle. Hay commonly made in this country would scarcely provide maintenance requirements. Consequently the self-feeding of silage permitted a substantial saving on the cost of imported concentrates in the overall costs of milk and beef production. That saving of concentrates coupled with the saving of labour provided a system which could help farmers to face the future with confidence.

A series of slides was then shown of various self-feed layouts.

Mr. K. V. Runcie said that the best way to start presenting the paper was to define what the rather non-committal title meant. It was another case of the Americanisation of some common, everyday terms used in this country; zero-grazing was the cutting and carting of grass to cows which were housed either in yards or in cowsheds or in small paddocks. In other words, they did not graze in the field but grass was cut and carted to them. It was not a new practice. When he had looked through the literature, he had found that in 1812, Caw had written a paper which was in the transactions of the Highland Agricultural Society of Scotland. The practice was, in fact, quite common in this country, particularly in the early part of the century and the later part of the last century, when town dairies were very much in favour, and grass was cut from outlying fields and carted into town. That was still practised quite widely in Southern Germany, and the western states of America.

The reason for the renewed interest in the practice, which died out in the 'thirties with the Milk Marketing Board, was two-fold: the first was that with the great increase in making the best of grass, there was evidence that there could be better utilisation of the grass sward; in conditions of continuous grazing, and cattle were allowed to graze continually over the same grass during winter and summer months, and at the latter part of the season a considerable amount refused grass contaminated by dung, etc. By keeping the cattle off the pasture, that factor was removed. The other reason was that with improved maintenance, improved machinery, etc., the sheer physical and economical job of getting grass to the cows was made much easier.

Because of that, they had, in Edinburgh, started to look at it in 1956. One reason which caused them to do that was that the farm was badly split by roads and inaccessible fields, so it meant that it was possible to use the outlying parts of the farm for milk production. That factor alone could mean that there was a place for that system. The cows were kept in yards, and kept in all the year

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round, carting grass to them. It was complementary to a system of self-feeding of silage where there was yardage accommodation. Other methods were, instead of keeping cows in yards—because they required bedding which was scarce and expensive—to keep them in a small paddock and cart the grass there. That led to problems particularly in winter. As with self-feeding, it had to be on concrete and there were foot troubles.

Zero-grazing presented a picture of cows under completely artificial conditions. Therefore, their milk production and health depended, as with pigs and poultry, on what was given to them in the way of grass and any supplementary. With the grazing animal, there was a certain amount of latitude in that in the actual process of being out of doors, grazing, there was an opportunity of picking up soil contamination. The mineral aspect might be a bit more complicated in zero-grazing than for animals out of doors. When animals were fed indoors, there was no selectivity at all; they had to eat what was given to them.

Experimental work had been carried out at two levels. Firstly, on a herd scale: that had been started with about 40 cows. One lot of cows were allowed to strip graze and the others were kept in a semi-open loose-housing yard. At the same time, that had been followed up with more critical work on individual animals, with smaller groups of animals so that certain aspects of the practice could be more critically assessed.

Running through the results so far, it had been possible to increase the stocking rate of the beasts by somewhere on an average of 12 to 20 per cent. Many claims were made by authorities that they could do better than that. One of the reasons why it had not been possible to do so much was that in the grazing management, an attempt had been made to cut out as far as possible the effect of contamination, by alternating grazing with cutting so that the area of dung through continuous grazing had been reduced under grazing management. Therefore the increase had been only 12 to 20 per cent. Many people who were changing from a system of continuous to zero-grazing might get a greater increase.

By using chromic oxide paper and assessing intake, it appeared to be the same under zero-grazing as under a system of strip grazing, but as with self-feeding, if the animals were under bad conditions of feeding, if they were crowded at a trough or if there was physical restriction from getting access to the grass, that could lead to a reduction in intake. Therefore milk yield would fall. It was quite important that freedom of access to the trough must present. With mechanical harvesting there was a risk of contamination of the grass with soil. While some might say that that was a good thing for giving an animal variety, it was a bad thing from the palatibility point of view. There was no evidence that forage harvesting materially affected it. Where there was bad operation of the forage harvester, there was soil contamination and the consumption dropped; in that respect, it had to be a 7-day-a-week job. They had tried cutting grass on Saturday and feeding it on Sunday. It was stored in trailers and heated up, and the result was that there was a reduction in consumption and a drop in milk yield, probably, by Tuesday. That was a disadvantage of the system; it meant a 7-day week and, depending on labour supply, that was a big factor in its application.

In a large-scale trial, the relative milk could not be assessed, but in a smaller-scale trial last year, it was found that milk production was the same and intake was the same. The only difference that could be detected between the two groups of animals was that it tended to fall by the latter part of the second period of trial carried out in the same summer in the animals zero-grazed. It was felt that that was perhaps due to the lack of selection by the animals in the zero-grazed group.

On the question of the quality of the grass, there was an unfortunate tendency in the practical management of zero-grazing, because one was cutting it, to allow it to get longer before it was cut; obviously it was quicker and easier to cut grass when it was longer. But then the animal was being offered a food which was of less value for milk production. Some of the poorer results which had been obtained were due to the fact that that trap had been fallen into, of allowing grass to get longer than was desirable for dairy cattle.

With regard to milk quality, as with milk production, there was no evidence that there was any difference. The figures in the paper showed milk quality both in butterfat and solids-not-fat percentages, which was acceptable.

On breeding performance, it was felt that animals fed indoors would not have so good a performance but there was no evidence of that. One could perhaps say from the figures that animals zero-grazed conceived better than those outdoors; figures for first service were 65 to 75 per cent. conception.

With regard to clinical troubles in the system of zero-grazing, the main attention had been on the question of foot troubles. Animals kept indoors, bedded with straw and sawdust with an area of concrete did have good feet in first-class condition; that applied in self-feeding through the winter as well. But animals going out to grass, depending on the season, did have a certain amount of foot-rot and foul-of-the-foot. That had been most marked. It was the only difference that could be seen on the clinical performance of animals.

Metabolic disorders, when they had occurred, occurred equally indoors and out of doors. Fortunately, there had been no trouble with hypomagnesaemia. There had been considerable trouble 5 years ago, animals in both groups dying equally.

On the live-weight of animals, it would be thought that when animals were not having to walk to graze, they would save energy and energy would be diverted to increased milk production or they would put on greater live-weight. Work was being done on the point of difference in maintenance requirements but live-weight figures did not show a tremendous difference between the groups. There was a slight increase in animals zero-grazed. Animals could be kept in better physical condition when housed and not having to walk to pasture.

With regard to the economics of the system, one was intensifying the system and it did cost more. It cost £9 per cow for the season and about half of that was taken up with the increased cost of bedding. That, on a yard system was one of the big restrictions of the application. Cows that were kept in had to be bedded, and with the increased housing of cows, bedding material—hay and straw—was getting more and more short. Whether or not it paid to spend an extra £45 per summer on carting and cutting grass depended very much on the individual circumstances of the farm. If the land saved was being utilised by a financially good crop or more milk cows, the system could be economical. If the land saved was utilised by low return crops, it was not economically justified.

He had finished the paper with one or two views on whether the system was justified and whether it would come in the future. There was likely to be an increase in the need for somthing like zero-grazing, because the tendency economically in dairy farming was towards larger units and larger herds. By that, he meant the 100, 200, 250 cow herd; and specialisation which was going to throw up veterinary problems of keeping so many animals together. A herd of 250 cows was envisaged, and if it was a success, four 250 units would be kept in a relatively small area, the person keeping 1,000 cows. Grazing large herds like that was difficult; sheer physical distance made it difficult. Therefore the food must be got to the cows all the year round, and in that respect, zero-grazing was obviously one of the answers. Large herds, where cows were forced to walk long distances to pastures, was a case for possible use of zero-grazing.

Secondly, where intensive grass management was practised, it was a vicious circle; the smaller the area the animal was kept on, the greater the possibility that it would not eat all the grass offered, and there was a case for keeping the animal off the pasture altogether.

Increasing economic pressure meant that there would be more fertiliser usage and people would be keeping more cows. Restriction of intake could be easily practised with zero-grazing and it allowed the introduction of alternative foods to grass, which in the Eastern counties of the country might have an attraction, but during the drier summer months, the provision of grass during June and July was

more difficult than in the more favoured western part of the country.

With regard to unsuitable grazing conditions, he had mentioned distance from farm buildings as one factor. Lack of fences and piped water would, by zero-grazing, allow one to keep dairy cows where previously it would not have been possible, and it would lead to improvement of the fertility of the soil and overall production.

Zero-grazing was not a practice one would advise for the average farmer. The level of grass management and utilisation on the average was not sufficiently high to warrant a person going over to an intensive system such as this involved. Perhaps the average production from grass could be increased by 20 per cent. more than was being obtained from zero-grazing by, perhaps, merely buying an electric fence and increasing stocking rate, without considering a system of zero-grazing.

Only when a person was up to a high level of grass management, or specific conditions existed, was it a more commercial application. It was a system which could work, could produce milk; the cows did not suffer because of it and therefore, if one required to do it, there was a considerable amount of information available.

The Opener

Mr. S. L. Hignett said that he wished to thank the Provisional Committee for inviting him to open the discussion at a most important symposium. Since the 3 authors were expert in their particular fields and had had considerable experience of the modern feeding method they described, he felt less than competent to perform that function.

The best he could claim was that, on the farm he managed early weaning of lambs and a modified form of zero-grazing had been practised. So far, however, they had not got round to the business of self-feeding silage. That was due to no antagonism but resulted largely from the shape and general layout of the farm, neither of which lent themselves to that relatively new development.

With regard to the early weaning of lambs, in their case, it would seem that providing the necessary routine immunisations had been applied to the ewes and provided the lambs received colostrum, serious disease problems were likely to result only if animals from a number of different sources were collected together.

In their particular method, instead of using a milk substitute, fresh cow's milk supplemented with sugar and sodium citrate was used; but they were setting out to rear worm-free lambs from experimental purposes, and during the rearing period, were not necessarily looking for the live-weight gain so important from Dr. Spedding's point of view. He wished to make it quite clear that, in the business of artificial rearing of lambs, Dr. Spedding had, in fact, been their father confessor.

The concentrate ration originally consisted of ground nut meal, sugar beet pulp and crushed oats; to start with, the milk was completely discontinued on the 17th day, but subsequent experience proved that that was somewhat too early.

There was considerable mortality at that stage, very often associated with pyloric impaction. They wondered if that was what Dr. Spedding referred to as abomasal bloat. They had found that most troubles were likely to occur at that early stage with lambs born as triplets which did not seem to possess the vigour to withstand the inevitable stresses. This was a point which might be well worthwhile considering when there was talk of the possibility of producing large numbers of lambs by selective breeding and hormone therapy and weaning them early.

Good quality hay was offered from 2 days of age, but until 2 months after weaning there had to be strict control of the amount available, it being withheld when the animals became abnormally distended.

Subsequent experience showed that the lambs did better on commercial lamb pellets or on a mixture consisting of ground nut meal one part, flaked maize one part and crushed oats 2 parts, than they did on the original ground nut meal, sugar beet pulp and crushed oats. At 3 months after weaning, the lambs were consuming about ½ lb. of concentrates daily.

In a further rearing operation only twin lambs were used and instead of them being weaned abruptly at 17 days, there was a week of diminishing milk, the allowance for 12 lambs being reduced by ½ pint per day for 7 days so that weaning took place on the 24th day.

Other points worth noting were that all lambs received pasteurella vaccine at 8 to 10 weeks and the injection was repeated in a further 3 weeks. All lambs were fed oxytetracyline in the milk at the level of 1 gm. per gallon. That tended to control a widespread type of scour which apparently had little or no ill effect on the affected animals. In any case, it persisted for no longer than 4 to 5 days. At 3 weeks of age, the lambs were injected with 100,000 i.u. vitamin A and 250,000 i.u. vitamin D_2.

When lambs were receiving milk, a multiple suckling unit proved highly successful and made it possible for 2 people to rear well over 200 lambs in a season.

It was found that attempts to ensure that lambs got colostrum could be tedious, and later, excellent results were achieved with milk supplemented with whole egg, sugar, cod liver oil and sodium citrate. Now, they did not insist on the lamb getting colostrum.

Two out of the 32 Dorset Horn ewes from which the lambs were removed at birth developed acute mastitis and *Pasteurella septica* was recovered from the mammary secretions in both cases. They were old ewes and one of them eventually died. That was in keeping with Spedding's finding that older ewes were more likely to develop mastitis in those circumstances. All the ewes were penned and received hay with a restricted allowance of water for one week, after which they were turned out to grass.

It seemed to him that should artificial lamb rearing ever receive serious commercial consideration, then the difference between profit and loss could well depend on disease control.

There was another small point, namely the suspected dieldrin poisoning which Dr. Spedding described. It was unlikely that, if the dip was of the correct strength, namely 0.05 per cent. and the lambs were not immersed, the losses were due to dieldrin toxicity. His colleagues had dipped lambs of 3 to 4 weeks of age in 0.1 per cent. dieldrin, and those lambs were actually immersed; much higher levels had been used successfully for adult sheep.

In connexion with artificial rearing, past experience had taught them how important it was for the lamb concentrate ration to have a low copper content. Otherwise, the risk of copper poisoning in the housed animal was a very real one. That was, of course, dealt with adequately by Dr. Ruth Allcroft on Wednesday morning (See *Vet. Rec.* **73.** 1,255).

He thought Mr. Turner's paper was very practical and dealt in a down-to-earth fashion with a subject which had excited a great deal of interest during the past few years. They had not gone in for the system although many hundreds of tons of silage were made and fed each year.

It was pleasing to note that Mr. Turner had paid due attention to the importance of making good quality silage and placed sufficient emphasis on the need for a high dry matter content without having to resort to cutting the grass at an advanced stage of maturity.

Mr. Turner was also to be congratulated on killing the popular belief that the feeding of large quantities of silage led to an increased incidence of ketosis in cattle, and to breeding problems. Silage itself was only likely to lead to ketosis when it was badly made and contained a high percentage of butyric acid, and had far too high a water content. General experience was that good quality silage prevented rather than caused acetonaemia. Similarly, the feeding of very large quantities of good quality silage, provided due attention was paid to maintaining a satisfactory vitamin D status of the cattle, was very likely to result in improved rather than diminished fertility.

He was particularly pleased that Mr. Turner had emphasised the importance of the silage and cattle being on a concrete apron. Those who had seen something of this method in practice must have been impressed with all the troubles that resulted in the early days when cattle were

standing about in mud—troubles by way of foot lesions and lesions of udders and teats. Furthermore, as Mr. Turner had emphasised, even with the concrete apron, it was essential to keep the slurry moved away regularly; otherwise, the foot, udder and teat problems were still experienced.

Mr. Runcie was to be complimented on providing such a well-balanced dissertation on the merits and demerits of zero-grazing of dairy cows. He had clearly demonstrated that systems of management, particularly where nutrition was concerned, were likely to give very different results in one environment from those obtained in others. That was something which, for obvious reasons, was near to his heart. Mr. Runcie clearly did not consider that zero-grazing was a panacea for all the problems associated with grassland management. Nevertheless, he was sure Mr. Runcie would agree that they were going to hear a great deal more of that method, with the oft-repeated cry for greater efficiency and with more and more mechanisation.

Apart altogether from the fact that zero-grazing undoubtedly made it easier to manage pastures efficiently, it also meant a rise in labour and machinery costs; therefore, it was doubly important to have an efficient and streamlined method of cutting and carting the grass.

That generally entailed the use of a forage harvester and special trailer, enabling one man to do the complete job. There were now on the market trailers which were really "mangers on wheels" and from which the cattle were fed directly. These cut out any man-handling of the grass.

From his point of view, it appeared quite satisfactory to employ both methods of grazing during the year, using zero-grazing in the first part of the season to obtain, particularly on heavy land, an earlier bite than would otherwise be possible due to the risk of damaging the pasture, and after that period, resorting to normal paddock grazing.

There was no doubt that, in many instances, greater use of zero-grazing would largely eliminate one of the common bugbears of the dairy farmer and the practising veterinary surgeon, namely foot trouble in cattle. Apart from that, few people realised the extent to which milk yield could be depressed if a herd had to walk any appreciable distance to the pasture, even when that herd was driven with due care and the cattle were unhurried. One sometimes wondered to what extent that forced exercise could also have an adverse effect on fertility under certain circumstances.

Some farmers practising zero-grazing maintained that cattle actually preferred fresh lacerated grass to grass in any other form, whether it was growing *in situ* or grass that had been cut with a mower. The reason for that was not definite, but it was probably due to increased palatability resulting from the liberation of certain juices during laceration of the grass.

There was not the slightest doubt that zero-grazing materially reduced the incidence of bloat on those farms where the pasture herbage was likely to lead to the condition.

He was very interested in the figures which Mr. Runcie quoted for the breeding performance of cows which were strip-grazed compared with those which were zero-grazed. Could the difference be due to the higher energy intake and decreased exercise of the zero-grazed animals? If so, it would support the well-founded belief that the energy allowance of cows had an important bearing on reproductive efficiency.

As a silage enthusiast, he thought Mr. Runcie's reference to the recent developments in the United States of America, where silage had been used as a succulent feed all the year round, no fresh green food being allowed, had a great deal to recommend it, apart altogether from the fact that it did not lead to sudden changes in the diet. In fact, such a scheme would certainly simplify the handling of labour on a mixed farm: but, of course, one would eventually arrive back in Mr. Turner's court and think in terms of self-feeding of silage throughout the year.

There would invariably be certain periods in the season when very wet weather prevented grass being cut for zero-grazing. On such occasions, silage would probably have to be fed instead, and the sudden brief change of diet usually appeared to have no adverse effect on milk yield.

In conclusion, he congratulated the authors of the 3 papers presented for providing such a breath of fresh air in placing before the meeting the facts as they saw them relating to the more recent developments in feeding methods for farm livestock—methods which were bound to have an important impact on the day-to-day activities of the practising veterinary surgeon doing large-animal work.

The General Discussion

Dr. Spedding said that Mr. Hignett had mentioned the age of weaning for artificially reared lambs, and whether weaning should be gradual or abrupt. He himself agreed that gradual weaning was preferable to abrupt weaning; that was what was done at the Institute, although the process was completed, in their standard rearing method, by 17 days. Nevertheless much evidence suggested that the weight of the lamb at weaning was probably a better guide; that, of course, depended upon the level of milk-substitute feeding at any given age. His lambs therefore, when 17 days old, were probably heavier at their high level of milk feeding than would be the case from feeding cow's milk equivalent. That applied again to triplets or any multiples; they were likely, because of lower birth weight to be even lighter for a given age. His impression was that the smaller the lamb at birth, particularly from multiple births, the longer would be the period of rearing. Fortunately, that did not necessarily involve more costly rearing, except in terms of labour, because the appetite of the smaller lambs was correspondingly less. He wished to make it clear that, as yet, they had not artificially reared any lambs from large litters produced by hormonal injection of the ewe. All that had been done was to rear very small lambs, down to 3 lb. birth-weight, which had been born as twins or triplets.

On the question of dieldrin poisoning, for those who had not actually read the paper, he would read the relevant passage:—

> "Losses in this year were heavy but the majority were ostensibly due to dieldrin poisoning, which resulted in the death of 17 of the lambs following dipping at 3 to 4 weeks of age."

The reaction was quite spectacular, with frothing at the mouth and a variety of other symptoms within 24 hours or dipping.

> "Dipping involved immersion of the body (not the head) in normal strength dip for 5 seconds."

That was the strength recommended by the manufacturers and the authors personally dipped the lambs.

> "Symptoms were consistent with dieldrin poisoning and no other cause of death was apparent *post mortem*. The poorer lambs were, in general, most seriously affected and it would appear that the use of a dieldrin dip for artificially reared lambs is not to be recommended at this early age."

That was an inevitable conclusion from their own experience. It was certainly not to be taken that any criticism was directed at that particular dip or any other containing dieldrin as used normally in farm practice. The animals were quite different from those a farmer would normally have. They were 3 to 4 weeks of age and very small, having been reared artificially, and the poorer ones were the ones that were most affected. One might question whether it was necessary to dip animals of that age, reared in that way, at all.

It had seemed to them to be a sound precaution because these small lambs, with a high incidence of scouring, were going into a system of intensive management. To avoid fly strike, they were dipped, with consequences reported earlier. The manufacturers of that particular dip were interested in the results and were kind enough to co-operate in that they themselves carried out small trials subsequently, and, broadly speaking, it could be said that they confirmed the results, in that, in a small number of cases of those lambs dipped at a comparable age, reared in the same fashion, they got the same trouble—apparent dieldrin poisoning. Again, it was in the poorer animals. It might have been a consequence of a very poor level of nutrition leading an animal, at that dipping time, to be in no condition to withstand it. One might suspect that it was due to lack of fat in the carcase.

Finally, he had every sympathy with Mr. Hignett's view

on the restriction of liquid intake by the ewe whose lambs had been removed. This procedure had been carried out for periods of 10 days with no ill effects on the ewes, which seemed happy and showed no signs of distress. The authors were not suggesting, however, that it was an ideal procedure, and successful results had been obtained by turning out ewes, immediately their lambs had been removed, on to extremely bare pasture.

Mr. J. B. Johnston (Shrewsbury) congratulated the speakers and the well-known personality who had started the discussion.

He would very much question the glib assertion, which was made in two of the papers and was often made when talking about the newer methods of husbandry such as self-feed silage, that, in fact, they had no effect on animal health; usually acetonaemia and infertility were quoted. He was sure that most practitioners would agree that, where there was a yard and parlour system of milking, under whatever type of management used, the biggest difference that it made to the practitioner was that he saw the disease so much later than he would under the more normal conditions of animal husbandry. He was quite convinced in his own mind that that loss of time in treatment resulted in a much more expensive treatment eventually. Yet that was very seldom shown as an adverse side of for example the self feeding of silage. It had to be remembered that where there were intensive methods of production, the tendency nowadays was to get as much work out of a man as possible; personal observation was usually at a minimum. It had to be stressed that where there were large collections of animals together, very close observation had to be made to detect disease in its early stages.

A final plea to those people who designed these new types of feeding systems: would they please see that there were adequate facilities for reasonable examination, treatment and isolation of animals. (Applause.)

Mr. W. W. C. Gibson (Ipswich) said that his first point concerned the mortality and the possible disease factor of Dr. Spedding's lambs. The number of lambs affected by scouring was quite remarkable and he wondered whether that was perhaps associated with the high quantities of milk-substitute fed. If the lambs were consuming large amounts at each feed, it was just possible that some of the liquid would be spilt into the rumen rather than going directly into the abomasum, causing upset digestion which could result in scouring.

Dr. Spedding and Mr. Hignett mentioned abomasal bloat and pyloric obstruction. These conditions might be related to the type of food being fed. Mr. Hignett mentioned that the concentrates being used in combination with hay were sugar beet pulp and oats, both of which have a high fibre content. He had found better results when maize was substituted for sugar beet pulp. He himself did not think that this was surprising and he thought Mr. Hignett might have even better results if he cut out the oats and substituted a higher energy cereal with a lower fibre content.

Turning to Mr. Turner's remarks, he felt that while both he and Mr. Hignett had stressed the value of good quality silage, they had not stressed the fact that good quality silage was not always produced at the present time. Mr. Turner mentioned that 100 lb. of good quality silage contained enough protein for the production of 4 gallons of milk. On his own calculations, that meant a protein equivalent of about 3 which would require a crude protein content of the silage to be something like 6 or 7 per cent., perhaps even more. From his experience of silage analysis, this amount was not seen very often and therefore under such circumstances, silage would not always support 4 gallons of milk but, on the basis of its protein content, only 2 or even 1 gallon.

Mr. Turner agreed that very little good quality silage was made. His concern had been making bad stuff themselves because, in their endeavours to make high protein silage, they were cutting the grass too young. When they had had protein of about 15 to 16 per cent. and good fermentation, they had fed beet pulp and barley up to 4 gallons and then a dairy cake after that.

They had quite a few cows that were now in the sixth and seventh lactation. They knew what the peak should be and had adjusted the addition of protein and dairy cake and reduced the cereal to see what effect it had on milk. Out of 10 cows tested over 2 winters, calving in November, there was no advantage from that. Then they reduced the protein and increased the beet pulp and barley higher than it had been previously. They had not got any extra milk, and because cereal ration was so much cheaper, they stuck to their cereal plus.

Dr. Spedding said that he had a high incidence of scouring in artificially reared lambs, in general, and the figures quoted were for fairly large numbers of lambs all lumped together. It would be seen from the table that the incidence of scouring was high. That included every animal which scoured, if only for one day, and the number that died was very small. But the case was reversed with abomasal bloat where not so many were affected but the mortality was much higher. A great variety of levels of milk substitute had been fed, with different frequencies, different total amounts and based on different milk powders; it had not been possible to find any association between the incidence of scouring and the level of milk feeding. He would not dream of saying, at that stage, that there was none but it had to be remembered that the level of milk feeding interacted with the frequency with which it was fed. What might be important to the lamb in keeping its digestive tract in order was whether on any one occasion it over-fed, and that might not be simply whether a large total was being fed; since the quantities of milk that a suckling lamb got were very high in comparison with most artificial methods, the sheer quantity could not be at fault, though he knew that two different liquids were being dealt with here. His impression was that with lambs artificially reared, and to some extent with calves too, if one wished to feed a higher level, it was wise to increase the frequency so that it got a little and often. In addition, it might well be advantageous that the animal should receive milk when it wanted it and never became really hungry.

The situation was not quite the same for abomasal bloat where it would be admitted that there was an association between that condition and the level of feeding. Probably that could be avoided by a lower level of feeding though, as yet, there was some disadvantage in that the interaction of frequency was not known.

Mr. I. F. S. Hay (Cirencester) asked whether any attempt had been made to ascertain what the mortality rate was. He gathered that most of the mortalities occurred in the lambs shortly after early weaning; presumably, under the extra stress imposed, mortality would be rather higher than usual.

Mr. Hignett said that, in their case, the pyloric impactation occurred after the lambs were taken off milk. The condition was diagnosed only on *post-mortem* examination and the mortality rate from this condition was approximately 7 per cent. of all lambs reared artificially.

On a point made by Mr. Gibson, he realised that hay and sugar beet pulp provided a good deal of fibre, but in the early days it was suggested that it would be an advantage to provide fibre for artificially reared lambs. They had not been very happy about the inclusion of sugar beet pulp in the concentrate ration and, when they ran into trouble, they had stopped using it.

Professor T. K. Ewer (University of Bristol) asked Dr. Spedding if he would say something about the concentrate ration he had fed to his lambs. Mr. Hignett had specified the different types of concentrate he had been using but there was no discussion on the composition of the concentrates used at Hurley; whether they had been varied at all, or what the cost was. He believed the total cost figure given included the milk.

He asked Mr. Runcie in assessing the economics of zero-grazing what consideration was given to the loss of nutrients to the soil which must follow; obviously, when one was grazing animals on pasture, one got some return. Presumably one could return some of the excreta in the zero-grazing system but some must be lost. Presumably, one had to depend on artificial fertilising to a greater extent. Had any calculations been made on that point?

Finally, he wished to make a suggestion that all scouring

should not be looked upon with equal concern. He had a notion that there was on occasion what one might call a physiological looseness of the bowels which was in no way a pathological condition. Everyone must have seen thriving ruminants scouring. Perhaps the passing scour in artificially reared lambs, which presumably were gaining weight satisfactorily, was not to be regarded with apprehension.

Dr. Spedding, referring to the question of concentrates, their composition and cost, said that they normally fed, to their artificially reared lambs, a proprietary lamb pellet, of small size. Where different kinds of concentrate had been compared, they had got differences in intake rather more clearly than they had got differences in nutritional value. As far as he was aware, given a certain satisfactory definition of concentrates, it had not mattered a great deal which kind had been fed, with regard to the performance of the lamb, but it had mattered rather more in the early stages what form it was in. Flakes and powders, which tended to get rather sticky, had frequently been found to be taken in at a lower level, and the small lamb seemed to take in more readily the small hard pellet. That seemed to have a greater influence than the actual composition.

They had fed that for some 5 to 6 weeks, made it available *ad lib.*, and the intakes were roughly inversely proportional to the intake of milk, or the actual amount taken varied with the level of milk feeding and went up sharply as soon as weaning was begun. Satisfactory results had been obtained with no concentrates at all, but where cut grass had been offered in the same way, the cut grass did the same thing as the concentrates: as the milk went down the intake of cut grass went up. Some hay was normally available with the concentrates.

The cost of the milk substitute and concentrates was quoted jointly for the rearing of Welsh Mountain lambs in 1959, as £2 per head, and in 1960, 11s. 6d., with rather better performance in the second year. That had been done simply to illustrate the fluidity of the situation; they were, at the moment, extremely ignorant about what sort of concentrate ration to feed to such small lambs; they were ignorant about their requirements, and could not say much more than that, except that, where those things had been varied, with experience it was possible to cut down the cost very markedly indeed. He was not in any position yet to indicate what the final cost of such an over-all system would be. Out of the 11s. 6d. in 1960 for rearing Welsh Mountain lambs on an artificial rearing system where milk was fed for 16 days, 1s. was the cost of concentrates per head and 10s. 6d. the cost of the milk substitute.

Mr. E. Conn (Belfast) asked if Mr. Turner always recommended that there should be a crop to cut for silage. With regard to the self-feeding accompanied by covered accommodation, could he give some idea of the approximate space per cow he would recommend.

With regard to self-feeding of silage for beef production, had he noticed anything with regard to carcase discoloration? He rather thought he had, with some carcases he had been examining. He wondered what future there might be for the wintering of young store cattle by that method, without supplemental feeding.

Mr. Turner said that there must be plans to get sufficient silage for self-feeding, which meant a heavier fertilising programme. Often, on an intensively stocked dairy farm, the cows grazed every area of grass; on less intensive farms, cows were not grazed and stayed off from the beginning of the season for cutting for silage.

The bedded areas had been greatly reduced where there was sufficient loafing area at the silage face. The loafing area could be made too big, but they were down to about 40 sq. ft. of area in the bedded area with about 50 sq. ft. of loafing area.

With regard to discoloration, he had heard butchers say in markets that they would refrain from bidding until the animals they knew had been fed on silage had gone. They had been tested by a number of cattle from the Institute, some fed on silage and others not, and the silage-fed *cow* could not be picked out. Mr. Conn might have his own experience but he knew of 3 tests made where the carcase of a silage-fed *cow* could not be picked out.

Mr. A. J. Wright (Macclesfield) said he was sure the audience would wish to join him in a hearty vote of thanks to the three speakers and to the opener. It had been a most interesting session, particularly to those engaged in large-animal practice. The Provisional Committee were to be congratulated on choosing four such experienced people, all of whom had such a comprehensive knowledge of their subject. The keen interest with which their efforts had been received would be obvious to them all. It was only a pity that more time was not available for a longer discussion. It had been very keen and many more people would have liked to speak. The speakers had their feet on the ground and had given a really unbiased picture, with results gained from real practical experience. He asked those present to show their appreciation in the usual way.

A CLINICAL WEEK-END IN BRISTOL

Nearly 100 members of the profession attended a clinical week-end held in Bristol recently and organised by the south west region of the British Small Animal Veterinary Association. By arrangement with authorities of the Bristol Zoological Gardens, meetings were held in a spacious hall, starting at 2 p.m. on Saturday and ending in the early evening of Sunday. On the Saturday evening, a dinner dance in the local hotel provided an enjoyable social occasion for members and their wives. The Saturday afternoon papers were delivered by Mr. O. Graham-Jones who talked on zoological animals and showed 2 interesting films, and Mr. E. M. Pittaway who spoke on the use of laboratory aids.

The whole of Sunday was devoted to working sessions on the canine hip dealing with anatomy and radiography, clinical conditions and practical surgical demonstrations. The organisers of the week-end are to be congratulated on their initiative in arranging such a successful occasion and they, in their turn, express gratitude to the staff of the Bristol Veterinary School who collaborated with them in providing both speakers and facilities.

In view of the success of this week-end, it is hoped that the B.S.A.V.A. will organise similar functions in the future.

THE NORTH OF ENGLAND DIVISION

A very successful dance in aid of the V.V.B.F. was held in the Banqueting Rooms, Gosforth Park Race Course, Newcastle upon Tyne, on December 13th. The President, Mr. D. Buntain, and 25 members were present with their ladies and guests, making a total attendance of 130. The only official guest was Dr. Hugh Dickie, President of the North of England Division of the B.M.A., who was accompanied by his wife.

Divisional News

THE AYRSHIRE VETERINARY ASSOCIATION

A meeting of the Division was held on Thursday, November 2nd, 1961. The President, Mr. W. G. Johnston, called the meeting to order at 7.40 p.m. Eighteen members and 4 visitors signed the attendance book.

Apologies for absence were received from 2 members.

The minutes of the previous meeting held on October 5th, 1961, were read, and their adoption as a true record was proposed by Mr. J. Begg and seconded by Mr. A. M. Smith.

Arising from the Minutes

The Secretary read a letter from Mr. John McQuaker of Stranraer thanking the Division for conferring on him an Honorary Life Membership. The receipt for £4 received from the Treasurer of the Victoria Veterinary Benevolent Fund was displayed.

Correspondence

A letter from the General Secretary of the B.V.A. concerning the composition of the Council of the B.V.A. was read and thoroughly discussed. It was agreed to adopt the recommendations made by the Sub-committee on Elections to Council, and it was also agreed to recommend that the Sub-committee's recommendation concerning a substitute to attend Council and Committee meetings should be implemented.

Next Meeting

The Secretary reported that the next meeting would be held on Thursday, December 7th, in the same room and that an address on "Human Plastic Surgery," illustrated with slides, would be given by Mr. J. C. Mustardé, F.R.C.S., consultant plastic surgeon.

New Member

Mr. J. M. Watson was proposed for membership of the Division.

Other Business

The Secretary mentioned that the Victoria Veterinary Benevolent Fund Dance organised by the Ladies' Guild of the Dumfries and Galloway Division would be held on November 9th in Dumfries, and also that the arrangements for the Ayrshire dance were well in hand.

Speakers

The President then introduced the two speakers, Mr. W. A. Whiteford of Strathaven and Mr. D. McLauchlan of Stranraer, both of whom opened a general discussion on "Diseases of the Bovine Stomach." A most enjoyable and stimulating exchange of views and experiences followed in which most of the members participated.

THE CENTRAL VETERINARY SOCIETY

An ordinary general meeting of the Society was held on October 5th, 1961, at the Royal Veterinary College, Camden Town, by kind permission of the Principal. The President, Mr. Leonard Henderson, took the chair at 6 p.m. Thirty-two Fellows and 43 visitors attended the meeting. Apologies for absence were received from 12 Fellows.

Minutes

The minutes of five previous meetings, all of which had been published, were confirmed.

Nominations and Elections

Six new Fellows were elected and one nomination was announced.

Presentation

A gavel and block was presented to the Society by Mr. Michael Young, the Senior Vice-President, and was accepted with thanks by the President on behalf of the Society.

Obituaries

Professor McCunn paid tribute to 3 valued members of the Society who had died since the last meeting. The company stood in silence to honour the names of Mr. E. F. Lewis, Dr. A. B. MacIntyre and Mr. L. E. Stroud.

Address

Mr. A. M. Graham, Regional Veterinary Officer for the southern region, spoke on "Swine Fever and the New Slaughter Policy." As an introduction, Mr. Graham gave a brief account of previous attempts to control the disease in this country, and the principal reasons for the failure of the slaughter policy in the past. This appears to have been the clause permitting salvage of in-contact carcases, which kept the virus circulating. The new policy would involve total slaughter and destruction of carcases when the disease was confirmed. Premises would be disinfected, and no restocking permitted for 14 days after disposal of the carcases. Compensation would be paid at the rate of half-value for a diseased pig, and whole value for a healthy pig. The cost of the campaign would be high at first but should diminish rapidly and offered prospects of completely eradicating the disease. Mr. Graham then showed a series of transparencies depicting *post-mortem* lesions. A lively discussion followed. Mr. Graham, in reply to questions, mentioned the high cost of compulsory vaccination and the difficulties of ear-marking every pig in the country satisfactorily.

The speaker was warmly thanked by the President on behalf of the large audience present, and the meeting closed at 8 p.m.

THE NORTH OF ENGLAND VETERINARY MEDICAL ASSOCIATION

The Autumn General Meeting of the Association was held at the Veterinary Investigation Centre, Ministry of Agriculture, Fisheries and Food, Whitley Road, Longbenton, Newcastle upon Tyne, on Wednesday, October 4th, 1961, at 2.30 p.m. The President, Mr. D. Buntain, was in the chair, and there were 17 members present.

Films

Mr. D. Buntain welcomed the members and asked Mr. K. A. Forker to introduce the first item on the agenda which was a film comparing African swine fever and the American hog cholera. The symptoms and *post-mortem* lesions were very clearly shown, the African swine fever being much more severe in every aspect.

Next, films made at the Centre were shown. The subjects included a lamb with Listerella demonstrating typical turning movements; swayback, both post natal and delayed; scrapie; copper deficiency in calves, the colour changes in the skin being shown very well on the colour film.

After a discussion on the films the members moved freely about the Centre examining the demonstrations which were set out. These showed the methods of diagnosis in the laboratory, and included brucellosis, salmonellosis, mastitis, pulpy kidney and various worm infestations.

Mr. Muir proposed a vote of thanks to Mr. Buntain and his staff. The meeting had been most instructive, and the tea very enjoyable. Mr. Buntain, replying, was very pleased to have had the meeting at the Centre.

Minutes

The minutes of the previous meeting having been printed in THE VETERINARY RECORD were taken as read and signed as a correct record.

Correspondence

Letters were read from (1) the Editor of THE VETERINARY RECORD, who had promised to look into the possibility of reverting to the old method of printing the lists of disease infected premises, and (2) from the General Secretary of the B.V.A., concerning the notifications to practising veterinary surgeons of outbreaks of disease by Divisional Veterinary Officers. The honorary secretary was instructed to get further information.

Membership

Mr. J. E. Bradley was nominated for membership.

Clinical Club

It was decided to hold the next meeting of the Clinical Club at the Waterloo Hotel, Durham, at 7.45 p.m. on October 18th or 25. Light refreshments would be provided by the Division.

Other Business

Some discussion took place on veterinary pharmaceutical sales advertising policy, after which the meeting closed at 6 p.m.

THE SOUTH EASTERN VETERINARY ASSOCIATION

A meeting of the Association was held at the Royal Star Hotel, Maidstone, on Wednesday, October 18th, 1961. The President, Mr. J. D. Paterson, occupied the chair, and 24 members and 5 visitors were present. Apologies for non-attendance were received from 3 members.

Before opening the meeting the President extended a very hearty welcome to Mr. D. E. Gunner, the President of the Sussex Veterinary Association, who was attending as a visitor.

Minutes

The minutes of the last meeting were read, confirmed and signed as a correct record.

Membership

Mr. Graham Hunt and Mr. John McGain, Tonbridge, and Mr. James Millar, Dartford, were nominated for membership.

Paper by Mr. J. T. Done

The principal purpose of the meeting was to hear a paper delivered by Mr. J. T. Done of Weybridge, entitled "Some Diseases of Pigs." The speaker was introduced by the President, who said that Mr. Done was well-known to nearly all the practitioners present, who had from time to time availed themselves of his advice and help.

Mr. Done held the attention of the meeting with his interesting talk which was illustrated by excellent slides. He began by giving the latest information available on some of the virus diseases, particularly rhinitis, enzootic pneumonia, and the entero-viruses, which cause disorders of the central nervous system. He then mentioned several miscellaneous pathological conditions which he had met from time to time, and which he thought would be of interest to the members. The discussion was opened by Mr. Sambrook and many other members took part.

The President thanked Mr. Done for his address, his words being heartily endorsed by the members.

Current Literature

BOOK REVIEWS

Poultry Diseases Under Modern Management. The "Poultry World" Veterinary Adviser. Iliffe Books Ltd., London (1961). 13s. 6d.

With the exception of "Diseases of Poultry," edited by Biester and Schwarte, which is designed for the specialist avian pathologist, most books on poultry diseases have suffered from an attempt by the authors to cater for too wide a readership, with the inevitable result that they have been insufficiently detailed to be of value to the veterinary surgeon, whilst being too technical to be readily digested by the layman.

This book is exactly what it claims to be—a collection of published articles on poultry diseases originally prepared for a trade journal. The diseases are dealt with in a concise and readily understandable manner, although admittedly, in a few instances, there are slight inaccuracies inevitable with over-simplification. On the other hand the book gives the layman a background knowledge of the commoner infectious, parasitic and nutritional diseases, particularly as they are influenced to-day by the changing structure of the poultry industry, without detailing clinical symptoms or autopsy findings which might lead the lay reader to attempt his own diagnoses, with disastrous results. Nevertheless, the treatment is sufficiently informative to direct the poultry farmer's attention to the salient features of the more serious infectious diseases, the need for prompt and accurate qualified diagnosis, and the reasons leading to certain veterinary control measures.

While it cannot in any way be regarded as a textbook for veterinary students or a reference book for practitioners, it could, nevertheless, be read with interest and benefit as a purely background introduction to the importance of disease to the expanding poultry industry. Veterinary surgeons could, with confidence, recommend this book to their clients.

In all, 26 specific diseases are described and there are further chapters dealing with lameness, "worms," external parasites, diseases caused by fungi, nutritional diseases, etc. There are 162 pages including a useful index, and some quite helpful illustrations. The print is good, and the binding adequate.

Index of Proprietary Veterinary Preparations. KIRK, H. Nivek Publications Ltd., London (1961). 5s.

Since the Second World War, the use of proprietary preparations has become general in both medical and veterinary practice. The drug manufacturers market their products under trade names, which sometimes disguise the nature of the preparation. In the medical world, there are several authoritative publications to guide the physician in his choice of proprietaries; but in this country there has been no similar assistance available to the veterinary surgeon, although the veterinarian in North America has had the benefit of the Veterinary Drug Encyclopaedia for several years.

This handbook is a welcome addition to the clinician's equipment. It lists proprietary preparations, their indications, the methods of administration, and the manufacturers. The preparations are classified on a pharmacological basis, but a simple alphabetical index might be preferable. One would like further details of the preparations and their dosage, but this would obviously increase the size of the publication and therefore its price.

This index is issued free to subscribers to the "Vetinfile."

Infectious Diseases of Domestic Animals, by W. A. HAGAN and D. W. BRUNER. Pp. 1,012, 185 figs. (4th edition, 1961). Baillière, Tindall & Cox, London. 90s.

It is 18 years ago that one had the opportunity to review the first edition of this book. Since that time it has gone through 3 editions and now the 4th edition awaits appraisal. At the close of that first review one concluded that Hagan had provided "veterinary workers with a modern and authoritative book . . ." The steady demand for further editions has shown the conclusion was not mistaken. In the later editions Hagan has been joined by Bruner as a co-author, and it is Bruner who has undertaken the major responsibility of revision, with the exception of the chapters on viruses and viral diseases.

The framework of the book remains unchanged, as does the authors' objective of providing a textbook on infectious diseases with special reference to their aetiological factors. The framework comprises 7 parts; I. The Mechanisms of Infection and Resistance, II. Chemotherapy, III. The Pathogenic Bacteria, IV. Bacteria-like Pathogenic Organisms of Uncertain Classification, V. The Pathogenic Fungi, VI. The Pathogenic Protozoa, and VII. The Viruses.

In the main all these parts reflect adequately the great expansion in our knowledge of the aetiologies of infectious diseases, and the many new infections that have been defined in the last 20 years. If one has a reservation about the framework it would be to doubt the place or the value of Part II on chemotherapy. The treatment of this vast subject is sketchy and yet to do it credit would place it in a text-book on pharmacology or therapeutics, which in the reviewer's opinion is its proper place.

The descriptions of the diseases and their aetiologies, with which your reviewer is familiar, are competent over-all accounts of their salient features, but there are gaps and weaknesses which caused some personal irritation. The account of the differentiation of the Brucella species is disappointing, for to suggest that agglutinin absorption tests have a limited value in this connexion ignores the well established use of monospecific sera originally described by Wilson and Miles (1932), to whom no reference is made. In the same section the differential value of H_2S production received no mention. The authors continue to misinterpret the pioneer work of Minett, Stableforth and Edwards in stating that they

originally divided *Streptococcus agalactiae* into 3 types, type II and III now recognised as *Str. dysgalactiae* and *Str. uberis*. Consultation of the original references given by the authors failed to show that Minett and his colleagues made any statement to this effect. The section on the Avian Leucosis Complex does not reflect the modern consensus of opinion on this baffling group of conditions. No distinction is made between neoplastic lymphoid leucosis and the inflammatory lymphomatoses; furthermore, the authors favour the unitarian view that the lymphomatoses are all related. While admitting that the aetiologies of this very important economic problem are confusing, the amount known hardly justifies the fence-sitting by the authors.

A reviewer of technical text-books has a great responsibility, for he sits in judgment on work that has taken much time and study, and in most cases is the fruit of great experience. It is only too easy to wade through such books and seek out the imperfections, and to seize on those points of special interest to the reviewer which are not accorded the kind of attention he considers they deserve. However, in the end the reviewer has to step back from the detail and answer the following questions. Is this a good book? Is this a book he will use himself? Is this a book he can recommend others to read?

The answers to the first two questions are emphatically, yes. In respect to the third question, the book will be of value to all with experience of infectious diseases and their aetiologies, but as a teacher one will have to guide students in their use of its material.

News and Comment

THE BRITISH VETERINARY ASSOCIATION

7, Mansfield Street,
London, W.C.1.

Notice is hereby given that an Extraordinary General Meeting of Members of the British Veterinary Association will be held at the Royal Society of Medicine, 1, Wimpole Street, London, W.1, on Friday, January 19th, 1962, at 2.15 p.m.

To consider, and if thought fit, confirm the unanimous recommendation of the Council of the Association:

THAT the Articles of Association shall no longer apply to this company and that in lieu thereof the new articles of Association already prepared, a copy whereof has been initialled by the Secretary for the purpose of identification be adopted by the company.

JOHN A. ANDERSON,
General Secretary.

December 19th, 1961.

NOTE: *A copy of the new Articles of Association referred to in item of the Notice can be inspected by any member at the offices of the Association, 7, Mansfield Street, W.1, on any week-day (except Saturday) between the hours of 9.30 a.m. and 5.0 p.m. without fee.*

THE BRITISH COUNCIL

Mr. E. Bolton King has retired from the post of Assistant Controller, Arts and Science Division (Science Group) and Director, Science Department, and will be taking up a post as Science Officer for the British Council in Chile.

The Arts and Science Division of the British Council is being regrouped and the posts previously held by Mr. Bolton King are being separated. Dr. P. A. I. Tahourdin, sometime Science Officer in Italy, subsequently Assistant Representative in Yugoslavia and at present Representative, Israel, will become Assistant Controller of the group of departments which includes the Science Department.

RESEARCH STATION FOR WALES?

The South Wales Evening Post published the following recently:—

The Royal Welsh Agricultural Society has gained the support of the Welsh Parliamentary Party in their campaign to get established an animal health research station in Wales.

The M.P.s were won over after hearing the case put by a deputation from the society at the Commons.

Mr. T. H. Jones, of Llandeilo, Talybont, veterinary officer to the society, played the major rôle in explaining the society's case.

The party has formed a sub-committee which is to seek an early meeting with Mr. Christopher Soames, the Minister of Agriculture, and Dr. Charles Hill, the Minister for Welsh Affairs, to press the matter.

R.C.V.S. OBITUARY

We record with regret the deaths of the following members of the profession:—

BHATTACHARJEE, James, B.SC. (RANGOON), D.T.V.M. (EDIN.), 58, Gudge Heath Lane, Fareham, Hants. Graduated from the Royal Veterinary College, London, July 13th, 1928. Died in the Queen Alexandra Hospital, Cosham, Hants., on December 13th, 1961, aged 58 years.

CALLAGHAN, Richard David, 6, Pen Street, Boston, Lincs. Graduated Dublin, July 26th, 1923. Died December 14th, 1961, aged 59 years.

UNIVERSITY NEWS

Dublin

THIRD VETERINARY EXAMINATION
(Pathology and Bacteriology)

Pass: Greer, Samuel A. N., and McIlrath, Rose R.

FINAL VETERINARY EXAMINATION

(Clinical Medicine, State and Preventive Medicine, Surgery, Obstetrics and Reproductive Diseases)

Pass: Browne, Jane.

Glasgow

FINAL EXAMINATION FOR THE B.V.M.S. DEGREE

Abraham, Jacob A.; Alexander, George F.; Carlile, Joseph L.; Evans, Jacqueline I.; Ingram, John F. W.; Mackenzie, William I.; Martin, Edward C.; Russell, Thomas M.; Stewart, Ian A.; Wilson, Angus F. W.; Wilson, Robert J. W.; and Young, Ian M.

PERSONAL

Births

CAMERON.—On December 10th, 1961, to Elizabeth, wife of I. W. Cameron, B.SC., M.R.C.V.S., Veterinary Officer, Tanganyika, a daughter, Janet Antonia.

MCFARLAND.—On December 9th, 1961, to Audrey, wife of Andrew G. McFarland, B.V.SC., M.R.C.V.S., of 7, College Hill, Shrewsbury, a son, Mark.

SYKES.—On November 27th, 1961, to Brenda, wife of Kenneth C. Sykes, B.VET.MED., M.R.C.V.S., of 79, High Street, Winterbourne, Nr. Bristol, Glos., a son, Paul.

COMING EVENTS

January

10th (Wed.). W.C.V.A. DEVON BRANCH. Clinical Meeting at the Church House Inn, Harberton, Totnes, 7.30 p.m.

17th, 18th and 19th (Wed., Thurs. and Fri.). B.V.A. Committee and Council Meetings in London.

24th (Wed.). LANCASHIRE VETERINARY ASSOCIATION. General meeting at the University of Liverpool, 2.30 p.m.

February

2nd (Fri.). ROYAL COUNTIES VETERINARY ASSOCIATION. Annual Dinner Dance at the White Hart Hotel, Sonning-on-Thames, 7.30 p.m.

14th (Wed.). BRITISH EQUINE VETERINARY ASSOCIATION. First meeting at the Royal Station Hotel, York, 9.30 a.m.

JANUARY MEETINGS OF B.V.A. STANDING COMMITTEES AND COUNCIL

Tuesday, January 16th, 1962

5 p.m. Finance sub-committee.

Wednesday, January 17th, 1962

10 a.m. Veterinary State Medicine Committee.

11.30 a.m. Small Animals Committee.

2.15 p.m. Home Appointments Committee.

3.45 p.m. Parliamentary and Public Relations Committee.

Thursday, January 18th, 1962

10 a.m. Farm Livestock Committee.

2.15 p.m. General Purposes and Finance Committee.

Friday, January 19th, 1962

10 a.m. Meeting of Council at the Royal Society of Medicine: 1, Wimpole Street, London, W.1.

ADDRESSES OF DISEASE INFECTED PREMISES

The list given below indicates, first the date on which disease has been confirmed, followed by the postal address and local authority.

Anthrax

December 12th, 1961. J. Whitlow, Finger Post Lane Farm, Norley, Warrington, Lancs. (Parish: Norley). (Cattle.) CHESHIRE.

Fowl Pest

December 12th, 1961. R. J. Goodwin, Mayler Court, Ringwood, Hants. Disease at: Mayler Court Gardens, Ringwood, Hants. HAMPSHIRE.

December 12th, 1961. A. H. Darvill, Widmer End Poultry Farm and Hawbushes Farm, Widmer End, High Wycombe, Bucks. BUCKINGHAMSHIRE.

December 12th, 1961. F. M. Bird, The Old Rectory, Skeyton, Norwich, Norfolk. NORFOLK.

December 12th, 1961. H. Woodley, Stebbing Green Farm, Stebbing, Dunmow, Essex. ESSEX.

December 12th, 1961. L. Millson, 18a, High Street, Whittlesey, Peterborough, Northants. ISLE OF ELY.

December 12th, 1961. R. Shambrook, Bedwell Park Farm, Essendon, Hatfield, Herts. HERTFORDSHIRE.

December 12th, 1961. R. R. Lindsey, 54, High Causeway, Whittlesey, Peterborough, Northants. ISLE OF ELY.

December 12th, 1961. J. S. Garbon, Forest Hall, Hatfield Broad Oak, Bishops Stortford, Herts. Disease at: Hornbeams, Rise Chase, Hatfield Heath, Bishops Stortford, Herts. ESSEX.

December 13th, 1961. A. J. Gale, 13, Delph Street, Whittlesey, Peterborough, Northants. ISLE OF ELY.

December 13th, 1961. R. F. Perfect, Halfacre, Little Kingshill, Great Missenden, Bucks. BUCKINGHAMSHIRE.

December 13th, 1961. A. F. Dye, McIntyre House, New Buckenham, Norwich, Norfolk. NOR 04X. NORFOLK.

December 13th, 1961. Mrs. A. M. Harrod, Holbrook, Badgeworth Lane, Badgeworth, Cheltenham, Glos. GLOUCESTERSHIRE.

December 13th, 1961. G. H. Coles, 12, High Causeway, Whittlesey, Peterborough, Northants. ISLE OF ELY.

December 13th, 1961. J. Mosley, Ownead Hall, Buxton, Norwich, Norfolk. NOR 61Y. Disease at: 104, Hungate (D. F. Fields, Agent), Aylsham, Norwich, Norfolk. NOR 07Y. NORFOLK.

December 13th, 1961. W. A. Millins, Valley View, Bedmond, Abbots Langley, Watford, Herts. HERTFORDSHIRE.

December 14th, 1961. N. R. Smith, 21, Cemetery Road, Whittlesey, Peterborough, Northants. ISLE OF ELY.

December 14th, 1961. C. Baker, Church Farm, Autingham, North Walsham, Norfolk. Disease at: Oaks Farm, Carleton Rode, Norwich, Norfolk. NORFOLK.

December 14th, 1961. K. Martin, Mullock Farm, Corfe Mullen, Wimborne, Dorset. DORSET.

December 14th, 1961. G. C. Padfield, Chambers Manor, Epping, Essex. Disease at: Copped Hall, Epping, Essex. ESSEX.

December 14th, 1961. H. Cook, 33, Greenways, Bunwell, Norwich, Norfolk. NOR 01X. NORFOLK.

December 14th, 1961. Mrs. P. Hollingdale, Castroman, Stony Lane, Burton, Christchurch, Hants. HAMPSHIRE.

December 14th, 1961. Mrs. R. M. Brown, Cyprus Cottage, North Road, The Reddings, Cheltenham, Glos. GLOUCESTERSHIRE.

Swine Fever

December 12th, 1961. F. R. Mann, Yew Tree Farm, Laxfield, Woodbridge, Suffolk. EAST SUFFOLK.

December 12th, 1961. Miss P. M. Colgrave, Sezincote, Warren Farm, Moreton-in-Marsh, Glos. GLOUCESTERSHIRE.

December 13th, 1961. C. E. Saville, Holdens Farm, Stambourne Road, Finchingfield, Braintree, Essex. ESSEX.

December 13th, 1961. V. Higgins, 44, Ridgill Avenue, Skellow, Doncaster, Yorks. Disease at: Allotments, Ridgill Avenue, Skellow, Doncaster, Yorks. YORK, WEST RIDING.

December 13th, 1961. F. Taylor, 28, Central Drive, Three Lane End, Whitwood Mere, Castleford, Yorks. Disease at: Three Lane End Allotments, Whitwood Mere, Castleford, Yorks. YORK, WEST RIDING.

December 13th, 1961. A. G. & W. Dodkins, West Acre, Grange Lane, Little Dunmow, Essex. ESSEX.

December 14th, 1961. C. G. Burton, Riverlands Farm, Sibthorpe, Newark, Notts. NOTTINGHAMSHIRE.

Letters to the Editor

The views expressed in letters addressed to the Editor represent the personal opinions of the writer only and their publication does not imply endorsement by the B.V.A.

SCIENTIFIC

Amicarbalide in East Coast Fever

Sir,—Amicarbalide isethionate* (3:3′ diamidinocarbanalide di-isethionate) is a useful drug for the treatment of *Babesia divergens* infection (Ashley, Berg & Lucas, 1960; Beveridge, Thwaite & Shepherd, 1960). Shone, Wells & Waller (1961) concluded that amicarbalide possessed advantages over phenamidine isethionate for the treatment of *Babesia bigemina* infection in cattle. It can, therefore, be anticipated that the compound will soon be available in Africa for the treatment of redwater in cattle due to infection with *B. bigemina*. Since most newly introduced babesicides and antimalarial drugs are immediately used for the treatment of field cases of East Coast fever, for which there is as yet no effective therapy, it is felt advisable that the following trial be reported.

The strain of *Theileria parva* used was the one known as *T. parva* (Muguga) and it was maintained and transmitted according to the methods described by Bailey (1960). High-grade crosses of various cattle breeds of European origin, reared in districts of Kenya free from East Coast fever, were infected when 2 to 3 years of age. The method suggested by Brocklesby, Barnett & Scott (1961) was employed to evaluate the drug which was administered, in a 50 per cent. w/v solution, by deep intramuscular injection. The dose used was 20 mg. per kg. in all cases. Treatment was commenced on the first day of fever (a rise of temperature to 103.0° F. or more coupled with the demonstration of macroschizonts in lymph-node smears). The main criterion was "death or recovery" but thin blood films and smears prepared from the enlarged superficial lymph nodes were stained with Giemsa and examined. The rectal temperature was taken each day.

Twelve cattle, divided into 3 groups of 4 animals, were treated. Group I was treated with a single injection on the first day of fever; Group II received injections on the first, second and third days of fever and Group III were treated daily throughout the febrile period.

All the treated cattle died.

In Groups II and III the febrile reactions were somewhat abnormal, transitory remissions of fever occurring together with a general slight reduction in the average temperature during the reaction. However, an examination of smears revealed that the multiplication of the parasite and the production of intra-erythrocytic piroplasms was unaffected. *Post-mortem* examination did not reveal any evidence of systemic toxicity but the drug was evidently very irritant, causing considerable necrosis of the muscles surrounding the injection sites.

The expected mortality rate in susceptible high-grade cattle infected with *T. parva* (Muguga) was 96 per cent. (Brocklesby *et al.*, 1961). Consequently at least 3 animals in each treatment group of 4 had to survive if the findings were to be significant at the 0.05 per cent. level of probability. Since all the animals died it was concluded that amicarbalide was not an effective drug for the treatment of East Coast fever.

The above authors stated that, in order to be 95 per cent. certain that a treatment would not reduce the mortality rate from 96 per cent. to 50 per cent., 7 out of 8 treated cattle would have to die. In the present trials only 4 cattle were included in each group. If, however, Groups II and III be considered together as "a treatment consisting of at least 3 consecutive daily injections," the statement can be made that such a treatment will not reduce the mortality rate to 50 per cent, since all 8 cattle died from East Coast fever.

I am grateful to Mr. C. G. L. Beveridge, of May and Baker Ltd., for his advice and for arranging supplies of amicarbalide and to Mr. K. P. Bailey for his technical assistance. This letter is published by kind permission of Mr. H. R. Binns, C.M.G., O.B.E., Director of the East African Veterinary Research Organisation.

Yours faithfully,

D. W. BROCKLESBY.

East African Veterinary Research Organisation,
Muguga,
P.O. Box 32,
Kikuyu,
Kenya.

December 5th, 1961.

* "Diampron" (May & Baker, Ltd.).

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The Influence of Thiabendazole, a new Anthelmintic, on Weight Gain in Lambs

Sir,—Thiabendazole (2-(4′-thiazolyl) - benzimidazole) has recently been shown to have very effective anthelmintic activity against a wide range of gastro-intestinal nematode parasites in sheep and other animals in U.S.A. (Brown *et al.*, 1961), and in Australia (Hebden, 1961; Gordon, 1961). Hebden used a dosage rate of 50 mg. per kg. live-weight in his trials with sheep, although he showed that up to 20 times this dose was not toxic. Thiabendazole is not at present commercially available in this country. This communication presents the results of a field trial using this drug under British conditions.

Most of the published work on thiabendazole has dealt with the effect of the drug on strongyle egg counts in faeces and on the numbers of parasites found in the gastro-intestinal tract during *post-mortem* examination. In addition Gordon (1961) showed an increased weight gain of thiabendazole-treated lambs compared with phenothiazine-treated and untreated controls.

In the present trial the live-weight gains of different groups of lambs were compared on a farm with a high sheep density where a parasitological problem was known to exist. The experiment was undertaken on improved mountain pasture in mid-Wales. About 250 ewes were grazed on a 40-acre plot starting in March, 1961. The ewes lambed in late April and early May, and with very few exceptions had single lambs. The ewes remained on the pasture until the first week of August, when they were removed. The 250 lambs remained on the 40-acre plot from birth until after completion of the experiment. No supplementary food was given at any time. Of the 106 lambs selected for the trial 5 lost ear-tags and 3 died suddenly: the results for these 8 lambs have been omitted from Table I. The lambs were divided into 4 similar groups with the same sex ratio.

The lambs were weighed in June when they were first dosed. They were weighed and dosed again in August, and finally weighed in October. Since the duration of these periods was not constant, the weight gains have been calculated as lb. per 4 weeks, so that a comparison between the two periods could be made. The weight gains for the different groups are shown in Table I.

TABLE I

	Controls	Phenothiazine	O.P.	Thiabendazole
Period 1	7.6	7.5	7.7	7.7
Period 2	6.3	6.5	6.8	7.3
Number in Group	26	23	24	25

Weight gains in lb. per 4 weeks of Welsh Mountain Lambs during Period 1 (June 26th to August 21st) and Period 2 (August 21st to October 6th). The dosage rates used were: Phenothiazine, June 26th—22.5 g. per lamb, August 26th—30 g. per lamb: O.P. = Organo phosphate (4 tert-butyl-2-chlorophenyl-methyl-methyl phosphoamidate), 150 mg. per kg. bodyweight: Thiabendazole 60 mg. per kg. The two latter dosage rates were calculated on a basis of the average weight of the lambs in these groups.

There was no significant difference in weight gain of the lambs in the different groups for the first period, during almost all of which the lambs had access to their mothers' milk. During the second period, when the lambs were dependent upon the pasture for their food intake, differences between the groups became apparent. The phenothiazine group had a better weight gain than the control lambs, and the organophosphate group better than either of these, although these differences were not statistically significant. The greatest weight gain was shown during this period by the thiabendazole group, and the difference in weight gain between this group and the control lambs was statistically significant at the 5 per cent. level.

In none of the groups was the weight gain during the second period as great as it had been during the first. The absence of any milk to supplement the grass diet, the probable increase in worm burden associated with a wet August and September, and the sigmoid shape of the normal growth curve were probably all partly responsible.

This preliminary investigation suggests that thiabendazole may prove to be a useful anthelmintic agent especially if, as has been suggested, it is effective against immature gastro-intestinal parasites and also against migrating larvae. It also appears to be palatable, non-toxic and easy to administer.

I should like to thank Messrs. Merck Sharp & Dohme Ltd., for the supply of thiabendazole.

Yours faithfully,
D. B. ROSS.

Animal Health Trust,
Farm Livestock Research Centre,
Stock,
Essex.

December 6th, 1961.

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GENERAL

Dr. H. H. Green, O.B.E.

Sir,—My wife and I were fortunate in being in at the foundation of the Biochemistry Section at Weybridge in 1933. We can never adequately express the debt we owe to Dr. Green for all his help, encouragement and kindness. I know that the same must apply to many veterinarians and others who passed through his hands in the 20 years or so that he was head of the Department, as it became later.

From his wide experience Dr. Green appreciated the many points of impact of biochemistry on the field of health and disease of animals. Though he fought what at times seemed a losing battle, his permanent memorial remains in the Biochemistry Department at Weybridge, with its immense value to

other Departments there and to the practising veterinary surgeon. The debt of the veterinary profession to Harry Green is tremendous.

For his friends, and his junior colleagues especially, there will always be the memories of a kindly and helpful mentor. His precept and teaching were those of a great man, and they still hold good when one changes to work in another discipline, as I did in March, 1949. Dr. Green had so much to give, and he gave it freely to all who asked.

Yours faithfully,
W. M. ALLCROFT.

Breydon,
Blackdown Avenue,
Pyrford,
Surrey.
December 16th, 1961.

[We hope to publish a memoir of Dr. Green next week.—*Editor.*]

No. 36, Little St. Martin's Street

Sir,—Professor L. P. Pugh's article of October 28th interested me greatly, and it may be of interest to him that a veterinary surgeon lived at 35a St. Martin's Street, Leicester Square, for 7 years. Eighteen months ago, that address would have headed my paper.

The flats above the reference library belong to the Westminster City Council, and my father had one by virtue of being an officer of the council.

Patients were sometimes taken there on the way to Camden Town when I worked in the country, and I used to do quite a bit of telephone work from there when doing week-end locums in Hampstead. The street was quite impossible for parking, which was a hindrance.

The plateau of Northern Nigeria is an infinitely more pleasant place to live, and certainly much cheaper—I can appreciate Mr. St. Bel's motives for the move!

Professor Pugh has probably read the pleasant book called "The House in St. Martin's Street" (author forgotten) about Fanny Burney.

Yours faithfully,
E. ANNE STRUTHERS.

Sudan United Mission,
Gindiri, P.O. Barakin Ladi,
Northern Nigeria,
W. Africa.
December 7th, 1961.

Bi-lingualism

Sir,—One of the advertisements in your issue of December 9th asks for an English-speaking assistant for a Welsh border practice. As far as I know all members of the Royal College of Veterinary Surgeons have had to pass their examinations in the English language.

Would the advertiser regard the knowledge of an additional language a disadvantage in obtaining this appointment? I may be wrong, but I feel that I detect a racial prejudice in this advertisement.

Yours faithfully,
T. G. G. HERBERT.

Manor Hall,
Lampeter Road,
Aberaeron,
Cards.
December 10th, 1961.

Agriculturalists and Veterinary Knowledge

Sir,—Early this year Miller (*Vet. Rec.* **73.** 2) commented on the superficial training, on the animal side, given in the courses in agriculture available in Britain. In the circumstances it is surprising, if not ridiculous, to find that almost all activities having to do with animals in agricultural teaching, advisory and research projects (excepting veterinary education and practice), are in the hands of holders of one or more of the very varied agricultural qualifications.

A good example came to hand recently in the second report of the Hill Farming Research Organisation. On a Board of Management of 17 there is 1 veterinary surgeon; but a staff of 12 listed as engaged on animal studies lacks even this meagre representation. This is all the more difficult to understand when the contributions of the profession to the survival of this branch of farming are recalled; but memories are notoriously short.

On page 10 the Report states that the organisation is not equipped to undertake critical studies in animal health; but how it is possible to divorce these from animal production is a secret known only to the non-veterinary animal husbandry expert. In point of fact some of the work recorded might well have been left to a veterinarian.

At a time when so much lip service is being paid to the value of specialised scientific training it is disturbing to find administrative departments so ill informed or poorly advised as those responsible for work on farm animals appear to be. To those interested in veterinary education and the future of the profession, it must be disquieting to note that the animal scientist of the public and farming press, the animal nutrition adviser of industry, and the animal husbandry specialist and research worker in many institutions, frequently lacks the training in anatomy and physiology that we believe to be essential for the understanding of the results of any serious work on animals.

One sometimes wonders what would happen to these experts if they found themselves dependent for their incomes on fees collected from clients in return for requested services. It might be a good thing if the Chancellor of the Exchequer were prepared to find out in view of the need to reduce Government spending.

Yours faithfully,
D. H. ARMSTRONG.

85 Bon-Accord Street,
Aberdeen.
December 8th, 1961.